-3 1950

MAY, 1950 Vol. 39, No. 5

The Shop Teachers' Professional Magazine

AY -5 1950

INDUSTRIAL ARTS AND VOCATIONAL EDUCATION

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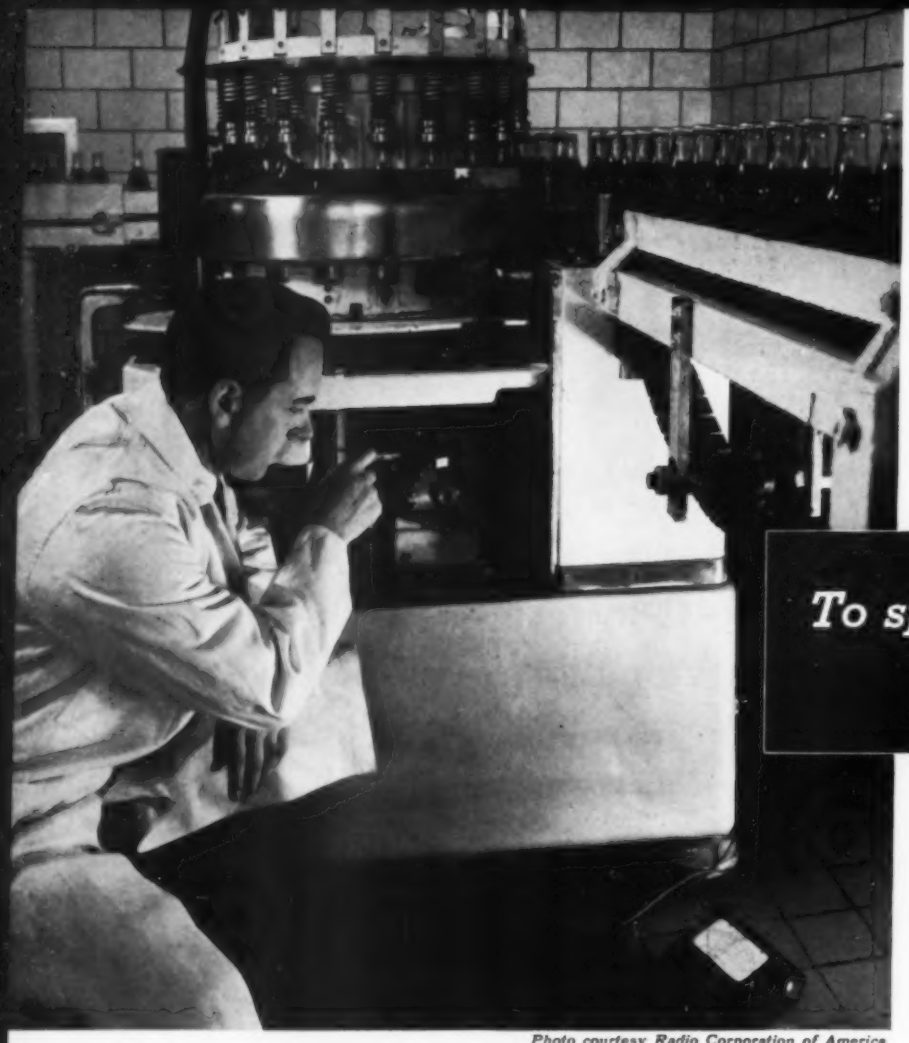

To spot the taint . . . and remove it

Photo courtesy Radio Corporation of America

Food on its way through factory processes to point of use is unavoidably exposed to the dangers that lurk everywhere. The naturally wholesome substance may become tainted and spoiled *despite* all care. Because of this risk, it has been found necessary to devise a machine which will not only unerringly "spot" the taint but cause it to be removed either manually or automatically.

The naturally wholesome individual, on his way to useful adulthood, is also exposed to dangers that lurk everywhere. So limited is human *knowledge* in the rearing of children that few come through the formative years unflawed, untainted, despite any loving care lavished upon them. So, goals and motivations become obscure. Actions become devious. The problems of life are no longer seen in *their essentially simple fundamentals.*

Time and time again, it is the educator who must "spot" the taint and attempt to remove it. Attempt he must, for he is almost the last line of defense. For this reason, as the wise educator knows, each step in the daily class routine is fraught with import. *For this reason,* he will not slur over any part of his contact with his students, but will test each moment for what it may hold of inspiration, of light upon new goals and the road leading thereto. No one need be reminded that careless selection of such important equipment as drawing instruments or the admission of tawdry tools to the class in mechanical drafting is a contradiction no conscientious instructor will tolerate.

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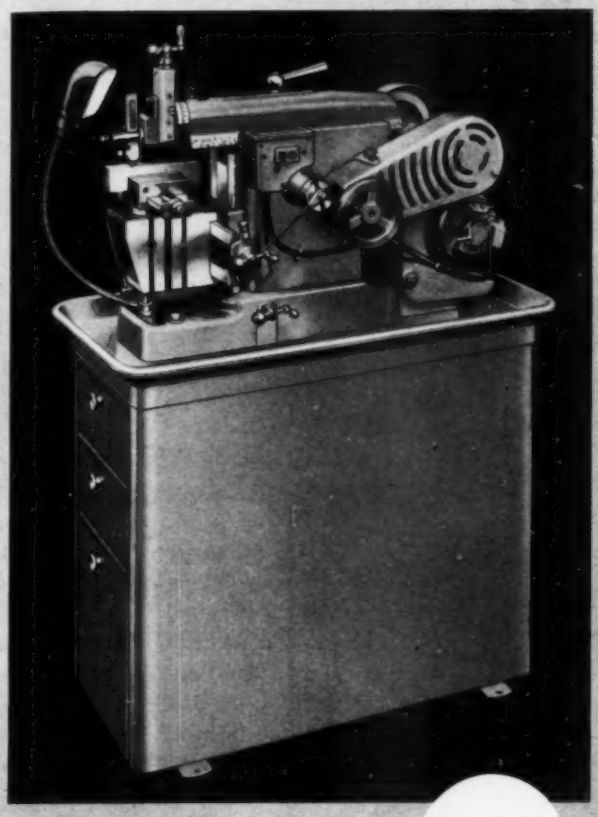
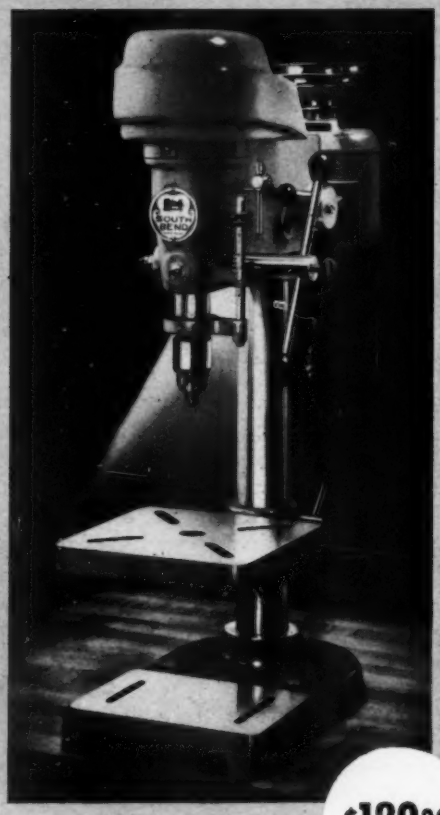


Better Built- Better Buys

7" BENCH SHAPER **$456.30**

Price includes vise; light fixture; switches; drive unit with belt guards; 1/3 h. p., 115 volt, 60 cycle motor and power cord—f. o. b. factory. (Steel stand $125 extra.)



14" DRILL PRESS **$129.30**

Bench model (also available in floor model) with chuck; built-in light; 1/3 h. p., 115 volt, 60 cycle motor, power cord and switches—f. o. b. factory.

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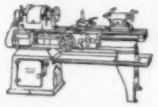
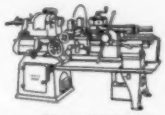
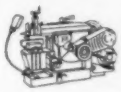


☐ 10" to 16" FLOOR LATHES



☐ ½" and 1" Collet TURRET LATHES



☐ 7" BENCH SHAPERS

☐ 14" DRILL PRESSES

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INDUSTRIAL ARTS AND VOCATIONAL EDUCATION, May, 1950, Volume 39, No. 5. Published monthly, except July and August, by The Bruce Publishing Co., 400 N. Broadway, Milwaukee 1, Wis. Entered as Second-Class Matter January 2, 1914, at the Post Office at Milwaukee 1, Wis., under the act of March 3, 1879. Subscription price in the U. S., Canada, and countries of the Pan-American Union, $3.00 per year; Foreign, $3.50; Single copies, 35 cents.

J-25 Tilting Arbor Saw . . .

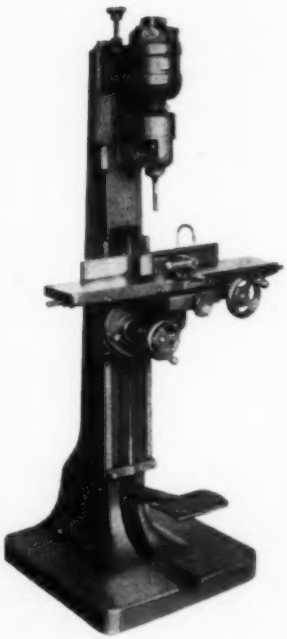
Cuts stock up to 3¼" thick. Cut-off capacity 17" without extensions — 25" with front table extensions. Vee-belt drive develops spindle speed of 4000 rpm. Heavy welded steel frame encloses all working parts. Built-in dust disposal system.

Shop-Proved J-Line Machines now available for Immediate Shipment

You can now benefit *immediately* from the proved performance, greater safety and moderate overall cost of the well-known J-Line woodworking machines. These popular Yates-American units can be shipped from stock to fill the needs of schools requiring top-quality, medium capacity equipment. Write for complete information on the machines shown here, as well as the J-18 Surfacer and J-70 Speed Lathe.

J-14 Band Saw

A 16" scroll band saw with 18" x 18" table that tilts 45° to right and 5° to left at saw line. Handles stock 8" high under guard. Well constructed machine for use where expense of larger tool is not warranted. Frame is cast in one piece. Guides are simple, highly efficient.



J-40 Mortiser

Mortises up to ½" in soft or hard wood. Can take stock up to 21". Will work to center of stock 8½" wide. Cuts mortises that are straight, smooth, square. Motor mounts on spindle, and entire unit lowers on gibbed ways. Compound table. Quickly converted for boring.

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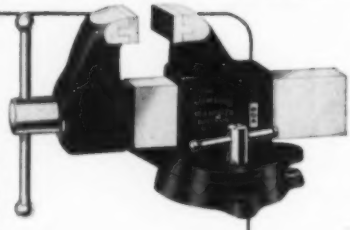
for many varied uses



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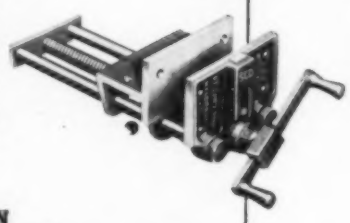
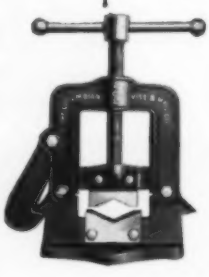
Columbian Malleable Iron MACHINISTS' VISES are guaranteed unbreakable! In addition to their exceptional strength, Columbian engineering has built into these vises the finest mechanical perfection and special features appreciated by users. Made in all standard sizes—3" to 8" jaw widths equipped with replaceable tool steel jaw faces. Available also in adjustable jaw and combination pipe vise types.



COLUMBIAN WOODWORKERS' VISES

Continuous Screw & Rapid Acting Columbian Woodworkers' Vises are finding increased uses in many plants particularly for the more ordinary types of pattern work. These durable low cost vises are sturdily built with jaw openings up to 12 inches.



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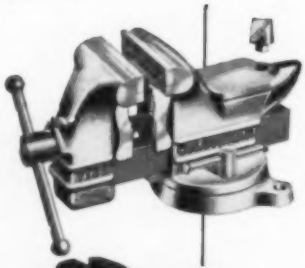

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Sjöström Shop Benches are made in single or double types.

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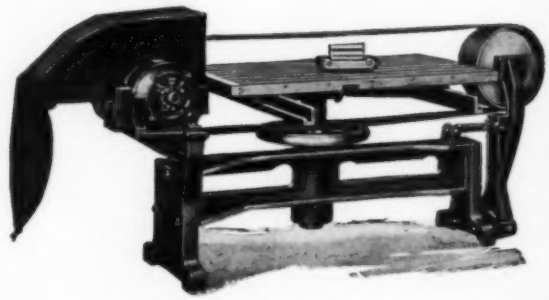
"OLIVER" No. 298 BELT SANDER



for smoothest work . . . a compact Sander with most of the features of our larger Sanders

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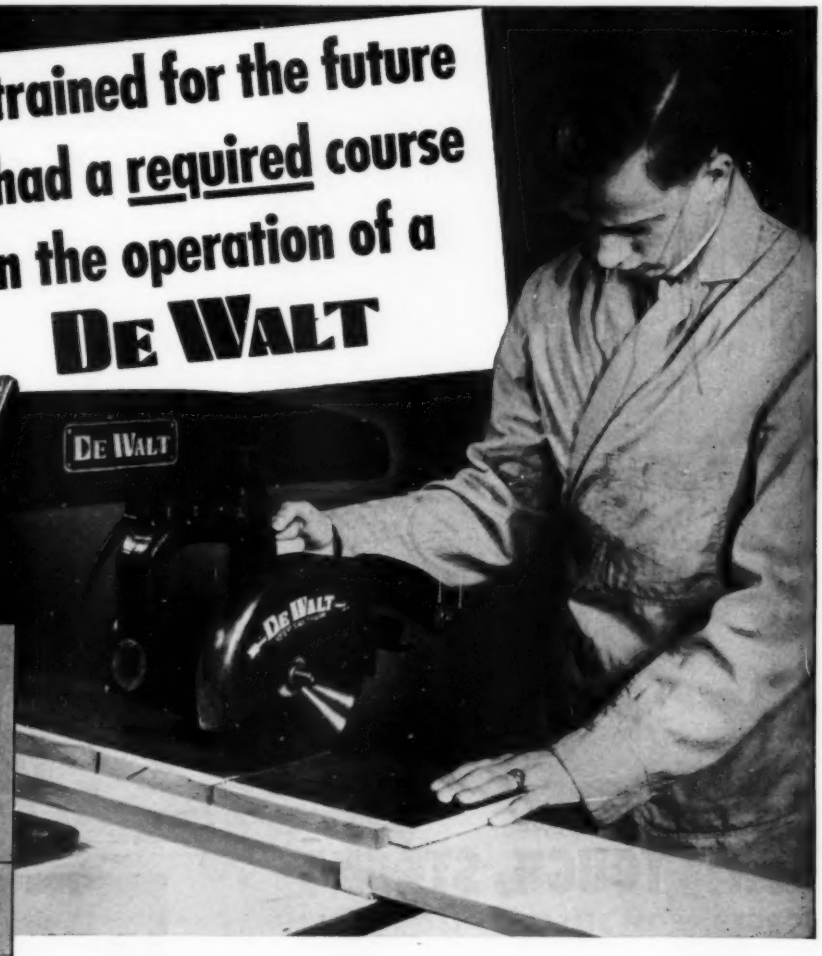
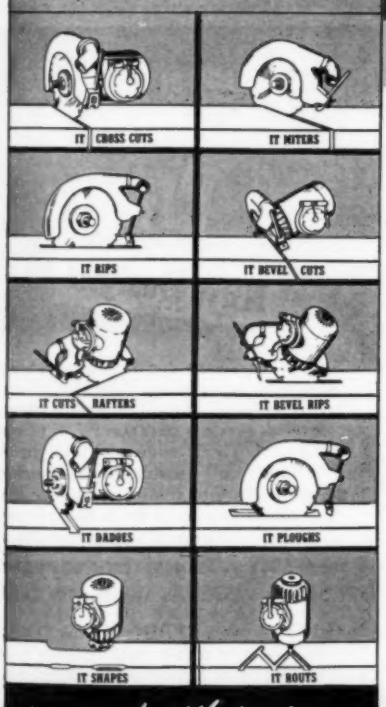
He's really trained for the future when he's had a required course in the operation of a DE WALT



DE WALT is a complete shop in itself



...and with proper tools makes any cut possible!

After the student has completed his basic training course in the use of hand tools, he should have a required course in the operation of DeWalt.

Knowing how to make the fullest use of this flexible, easy-to-operate machine, will give any student a head-start as he prepares for tomorrow's industry.

When he leaves school he will be fully acquainted with a machine that is destined to occupy a prominent place in tomorrow's industry. The perfection of the DeWalt saw has created new methods in cutting wood, making obsolete old-style equipment previously use.

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Four models 6" 12" 18" 24"
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One box or 10,000 — can be economically produced with the versatile new Di-Acro Box Finger Brake. Serves perfectly for all standard brake operations —an Acute Angle Bar converts the brake to a bar folder for locks, seams, hems and sharp angles. The unique Di-Acro Open End Finger forms square or triangular tubes and other similar parts. The Box Finger Bar can be easily mounted on all standard Di-Acro Brakes.

Send for 40 PAGE CATALOG describing DI-ACRO Shears, Punches, Benders, Brakes, Notchers and Rod Forters—also Power Shears and Benders.

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No. B 2½ SPEEDY MELT FURNACE

Complete with General Electric Blower and 3 Crucibles $350.00

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CAPACITY: 110 Lbs. of Brass; 90 Lbs. of Grey Iron or 35 Lbs. of Aluminum. Uses up to a No. 30 Crucible.

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SPEED: Melts Aluminum in 8 to 10 minutes, Brass in 15 - 18 minutes and Grey Iron in 45 to 50 minutes.

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"Utility"
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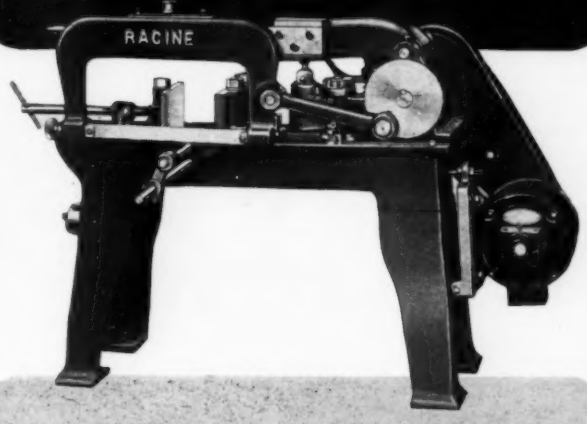

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Metal cutting, in any shop, can be surprisingly expensive with slow, inaccurate, outmoded equipment. The RACINE Utility is modern, fast and accurate — yet low priced. Simple to operate, easy and economical to maintain, it pays its way. Compact, it occupies little space.

The Utility is a dependable performer in all metals from soft tubing to hard alloy steels up to 6" x 6". Pressure and feed of the saw blade are hydraulically applied for smooth, oil-cushioned operation. Available in the Dry Cut model, shown above, and in the Wet Cut model with base-enclosed coolant reservoir.

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If you have a job that can be done hydraulically, it will pay you to investigate RACINE Oil Hydraulic Pumps, Valves and Boosters. Write for new catalog P-10-D.

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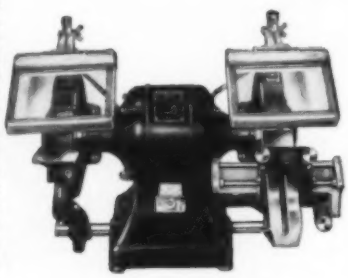
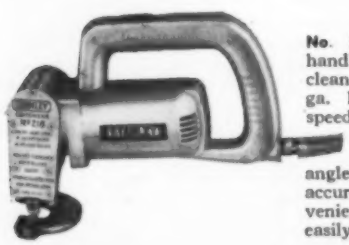


NEW, LARGER EYE SHIELDS, No. 601. Stanley Eye Shields, long-time favorite in schools, are now larger. Accommodate glass 10" x 6". Conveniently located toggle switch. Shields connected into grinder circuit so that light is on only when grinder is operating. Cannot be moved to off-guard position without dismantling. For all Stanley Grinders and most other makes of motor grinders, bench or pedestal.



No. 218 UNISHEAR. Easier to handle than snips, faster and cleaner cutting. Cuts up to 18 ga. hot rolled mild steel at speeds up to 15 ft. a minute. Needs only guiding. Straight lines, curves, angles, notches with hairline accuracy. Duplex handle for convenience in any position. Blades easily replaced and re-sharpened.

STANLEY

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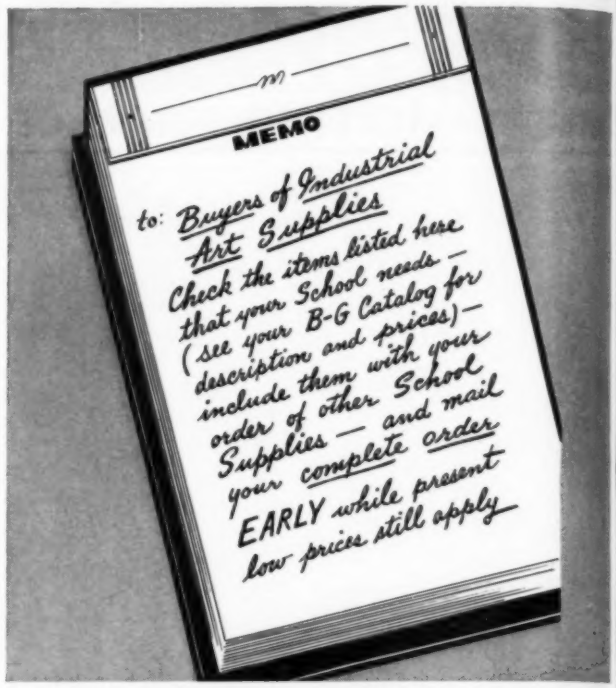
MEMO
to: Buyers of Industrial Art Supplies
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TESTED AND APPROVED BY SHOP INSTRUCTORS

$169.50 Saw Guard not shown with special ½-HP motor..... **$199.50**

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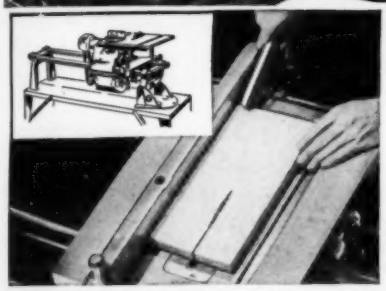
SHOPSMITH, the complete power shop in *one* tool, takes just 2 x 5 feet of floor space, costs only $169.50 (without motor). But in quality, accuracy and capacity, it surpasses all but the largest and best-equipped school shops.

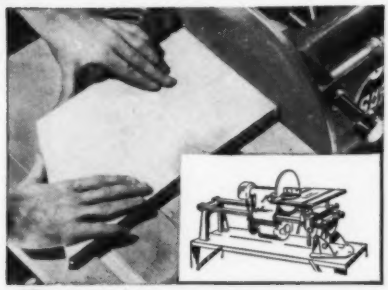
SHOPSMITH outperforms saws, sanders, lathes, drill presses costing $500. It is five heavy-duty, extra-feature tools in a unit so ingeniously engineered that you can convert from one tool to another *in less than 60 seconds*. SHOPSMITH takes all standard accessories. And at a reasonable cost you can add a jigsaw, jointer-shaper, drum sander, mortising attachment, etc.

The new industrial arts power tool, SHOPSMITH, offers flexibility in both operation and instruction. It provides a rich variety of machine tool experiences, readily transferable to single-purpose tools. In short, SHOPSMITH brings the greatest possible return in educational values for the money and space invested.

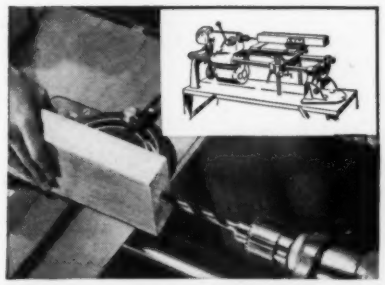
SHOPSMITH is ideal for a general shop, woodworking unit shop, crafts shop, or vocational agriculture shop. See it on display at any Montgomery Ward, leading hardware or department store. For complete information on school use of SHOPSMITH, mark and mail the coupon below.



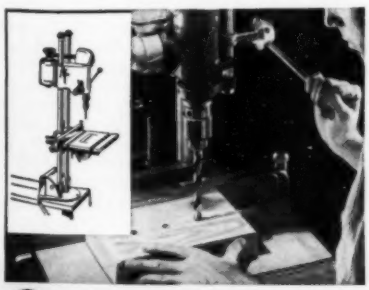
1 8-INCH CIRCULAR SAW. You'd pay $120 for a saw of equal quality, equal capacity. Effective table width, fence to blade, up to 48". Depth of cut 2¼". Sturdy tilting table with ball-crank raiser. Precision-tooled miter gauge. Self-aligning rip fence.



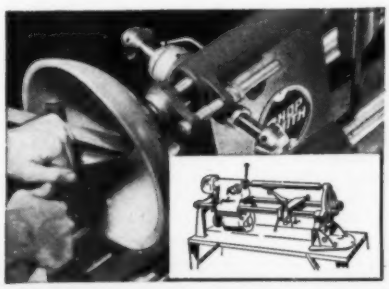
2 12-INCH DISC SANDER. No other disc sander can match it. None has 12" precision balanced disc, 14½" x 17" tilting table, both miter gauge and fence. And with SHOPSMITH you can feed disc into workpiece with feed lever for greater accuracy and safety.



3 HORIZONTAL DRILL PRESS. Ever try to drill the end of a table leg? Dowel stock for table tops? Mortise doors for locks? You can do it quickly and easily with SHOPSMITH. Work lies flat on table, no special jigs needed. Speeds from 875 to 3500 rpm. 4" quill feed.



4 VERTICAL DRILL PRESS. In vertical position, SHOPSMITH is both a bench and floor-type drill press. Drills to center of 15" circle. Has 4" spindle feed with right or left-hand feed lever. Jacobs key chuck takes drills from 5/64" to ½" in diameter. Extra large table with fence, miter gauge.



5 33-INCH WOOD LATHE. Turns stock up to 15" in diameter, 3" more than most heavy-duty lathes. Swivel-arm tool rest slides parallel to ways, lever-locks in position. Absolutely rigid lathe bed assures maximum accuracy—tubular steel ways take one ton stress.

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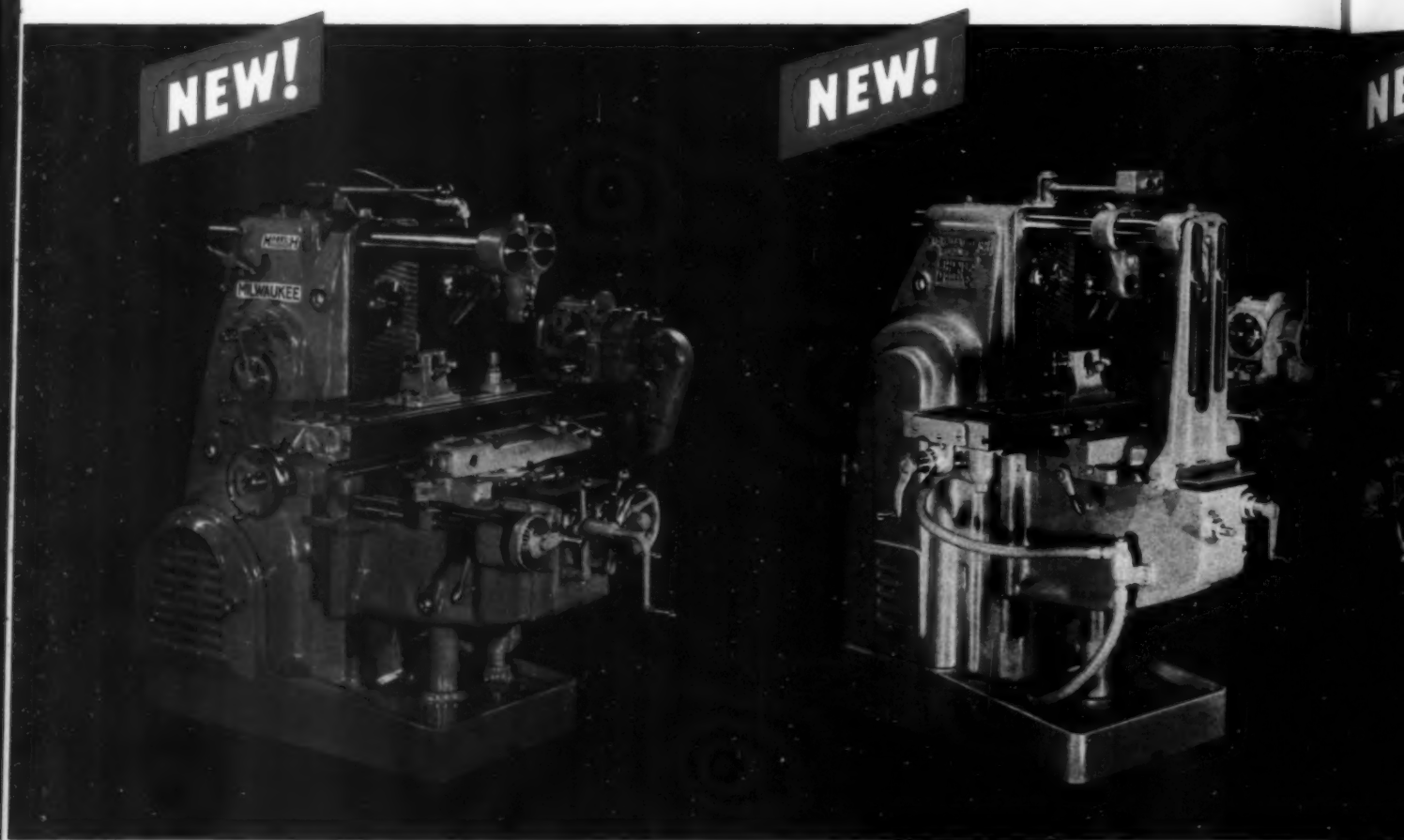

Model 2H Universal

IF YOUR vocational classes are to give thorough training in modern milling methods, you'll want a Kearney & Trecker Model 2H Universal milling machine. It provides centralized controls, broad feed and speed and wide working range . . . factors valuable to installations where space is limited and a variety of work must be accomplished. Safety protection includes interlocking controls, spring-actuated dials, totally enclosed motor and wiring. That means students get instruction under safest possible conditions. Write for catalog No. H20.

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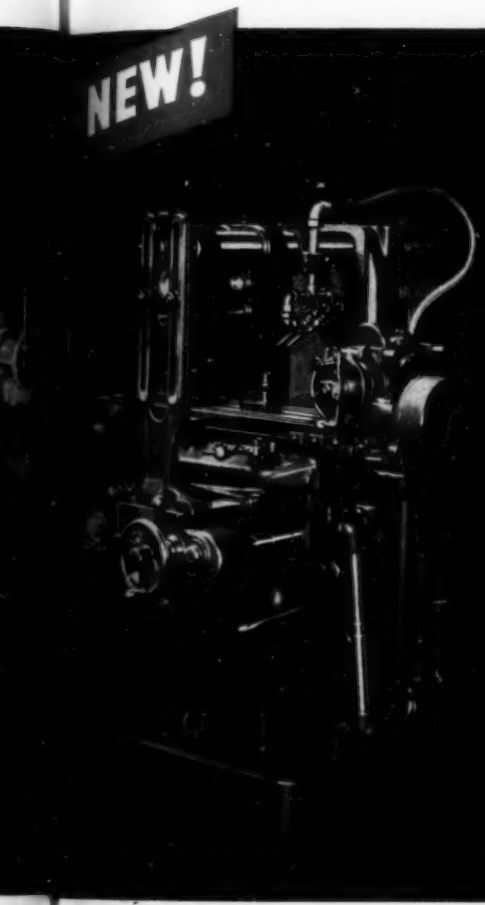

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YOU'RE LOOKING at one of the most popular machines we have ever built for general shop and vocational training purposes—the Model 2HL Universal. This machine features simplified operation with convenient directional controls. It has all the big machine features found on all Kearney & Trecker-Milwaukee milling machines—Solid Back Column, Cross Mounted Motor, Multiple V-Belt Drive, Double Overarms, Automatic Flood Lubrication, "Live" Rapid Traverse and complete Safety Control Interlocks. Write for descriptive Bulletin H13-A.

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University of California — Berkeley
Compton Union High School — Compton
University of California — Davis
Fullerton Union High School — Fullerton
Whittier Union High School — Los Angeles
Board of Education — San Francisco
Santa Ana High School — Santa Ana

COLORADO
School District No. 20 — Pueblo

CONNECTICUT
State Trade School - Stamford

ILLINOIS
State Teachers College — Charleston
University of Chicago — Chicago
Englewood High School — Chicago
Washburne App. School — Chicago
Joliet Township High School — Joliet
Moline Board of Education — Moline
Bradley Polytechnic Institute — Peoria
Rockford Senior High School — Rockford
Sterling Tp. High School — Sterling
University of Illinois - Urbana

INDIANA
Alex. Jr.-Sr. High School — Alexandria
Washington High School — East Chicago
Arsenal Tech. High School — Indianapolis
Purdue University - Lafayette
Vocational Education Dept. — South Bend
Gerstmeyer Tech. High School — Terre Haute
Indiana State Normal — Terre Haute

IOWA
Iowa State College - Ames
Davenport Public Schools — Davenport

KANSAS
Labette Co. Com. High School — Altamont
Kansas State Agric. College — Manhattan
Topeka Public Schools — Topeka
Wichita High School — Wichita

KENTUCKY
Theo. Ahrens Trade School — Louisville

MASSACHUSETTS
Beverly High School - Beverly
Brookline Manual Training — Brookline
Mass. Institute of Technology — Cambridge
East Boston High School — East Boston
Holyoke High School — Holyoke
Hyde Park High School — Hyde Park
Lawrence Industrial School — Lawrence
Medford Vocational School — Medford
Vocational School — New Bedford

MICHIGAN
University of Michigan — Ann Arbor
Dearborn High School — Dearborn
Ferdson School - Dearborn
Lowrie Jr. High School — Dearborn
Salena Jr. High School — East Dearborn
Cass Technical High School — Detroit
Chadsey High School — Detroit
Bishop School - - Detroit
Edwin Denby High School — Detroit
Wright School - - Detroit
Redford High School - Detroit
G-M Institute of Technology — Flint
Ottawa Hills School — Grand Rapids
Harrison Park School — Grand Rapids
Union High School — Grand Rapids
Copernicus Jr. High School — Hamtramck
Hamtramck Voca. School — Hamtramck
Jackson High School — Jackson
Central High School — Kalamazoo
Western State Teachers Col. — Kalamazoo
Boys Vocational School — Lansing
Michigan State College — East Lansing
Wilson School - Muskegon

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School District No. 12 - Ely

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Manual High & Voca. High — Kansas City
Cleveland High School — St. Louis

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University of New Hampshire — Durham
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NEW JERSEY
Boys Vocational School — Bloomfield
Central High School — Trenton
Rutgers University — New Brunswick

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New Technical High School — Auburn
Union Free School District — Batavia
North Senior High School — Binghamton
Peckham Vocational School — Buffalo
McKinley Vocational School — Buffalo
Vocational School No. 10 — Dunkirk
Board of Education — Hastings upon Hudson
State Agricultural School — Industry
Jamaica Continuation School — Jamaica, L. I.
Newton High School — Long Island City
Masena High School - Masena
Textile High School — New York
Queens College - New York
Auburn High School — New York
Bronx Vocational School — New York
Franklin K. Lane High School — New York
Geo. Hall Trade School — Ogdensburg
University of Rochester — Rochester
Rochester Shop School — Rochester
Saranac Lake Public School — Saranac Lake
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Collinwood High School — Cleveland
Case School of App. Science — Cleveland
Cuyahoga Heights School — Cuyahoga
Perkins Observatory — Delaware
Washington High School — Masillon
Toledo Vocational School — Toledo
Woodward High School — Toledo
Waite High School - Toledo

OKLAHOMA
University of Oklahoma — Norman
Board of Education — Ponca City
Daniel Webster High School — Tulsa
New High School - Tulsa

OREGON
Jefferson High School — Portland

PENNSYLVANIA
Allentown High School — Allentown
Lower Merion High School — Ardmore
Bethlehem Trade School — Bethlehem
Liberty High School — Bethlehem
State Teachers College — California
Vocational Machine Shop — Clairton
Erie East Tech. High School — Erie
Ridley Township High School — Folsom
Franklin High School — Franklin
McCaskey High School — Lancaster
Benj. Franklin Jr. H. School — New Castle
New Castle Trade School — New Castle
New Kensington High School — New Kensington
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West High School - Madison
Madison Vocational School — Madison
Marinette Vocational School — Marinette
Boys Technical High School — Milwaukee
Milwaukee Vocational School — Milwaukee
Neenah Senior High School — Neenah
Sheboygan Vocational School — Sheboygan
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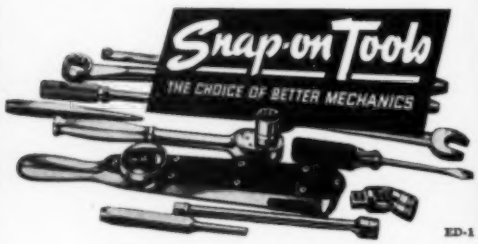

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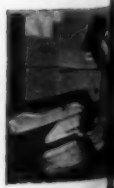

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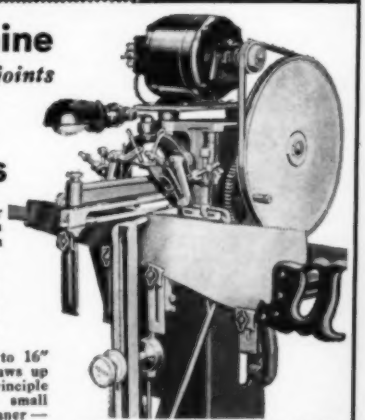

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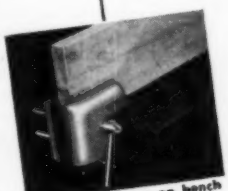

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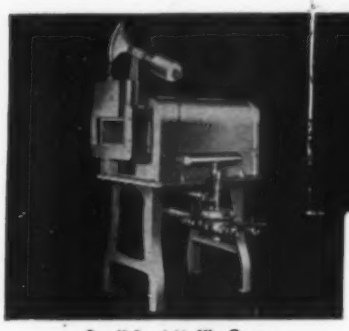

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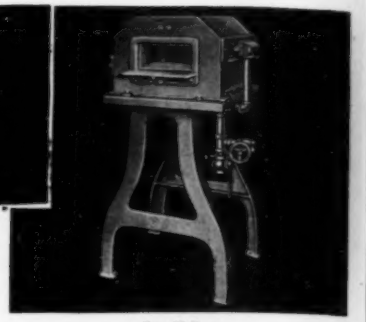

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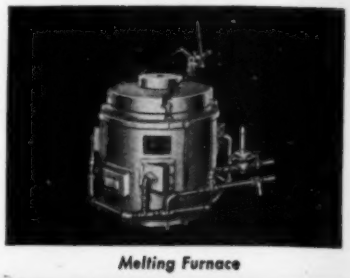

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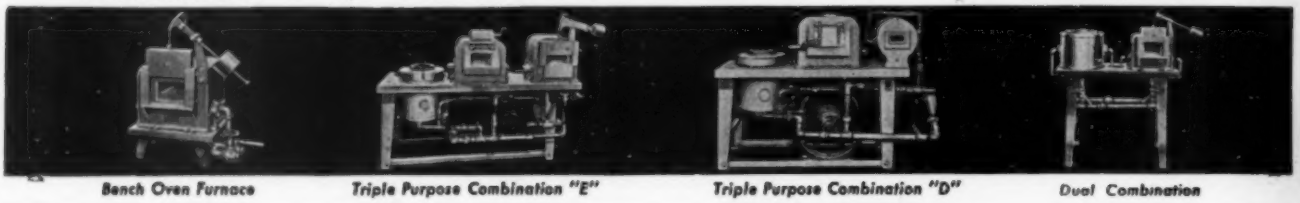

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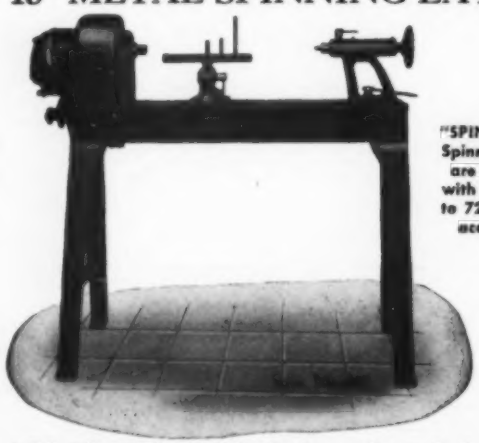

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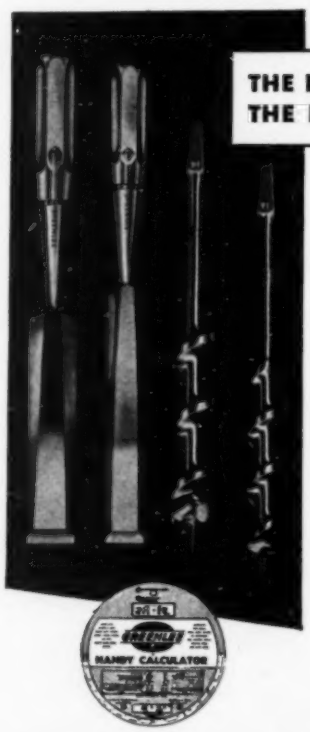

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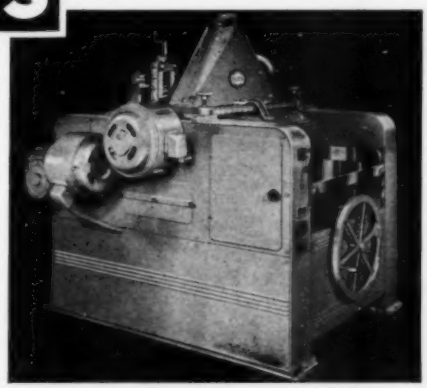

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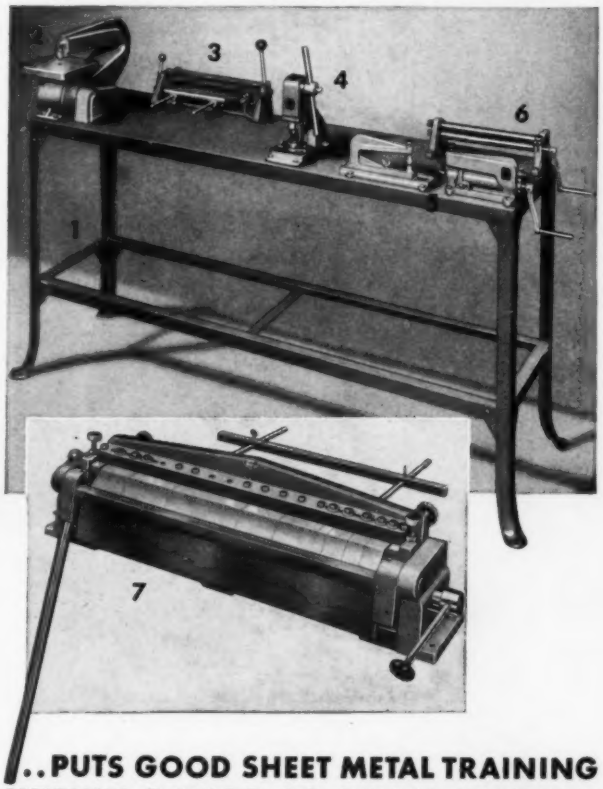

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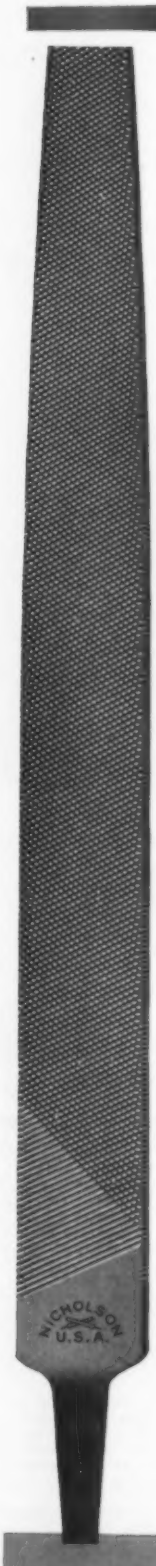

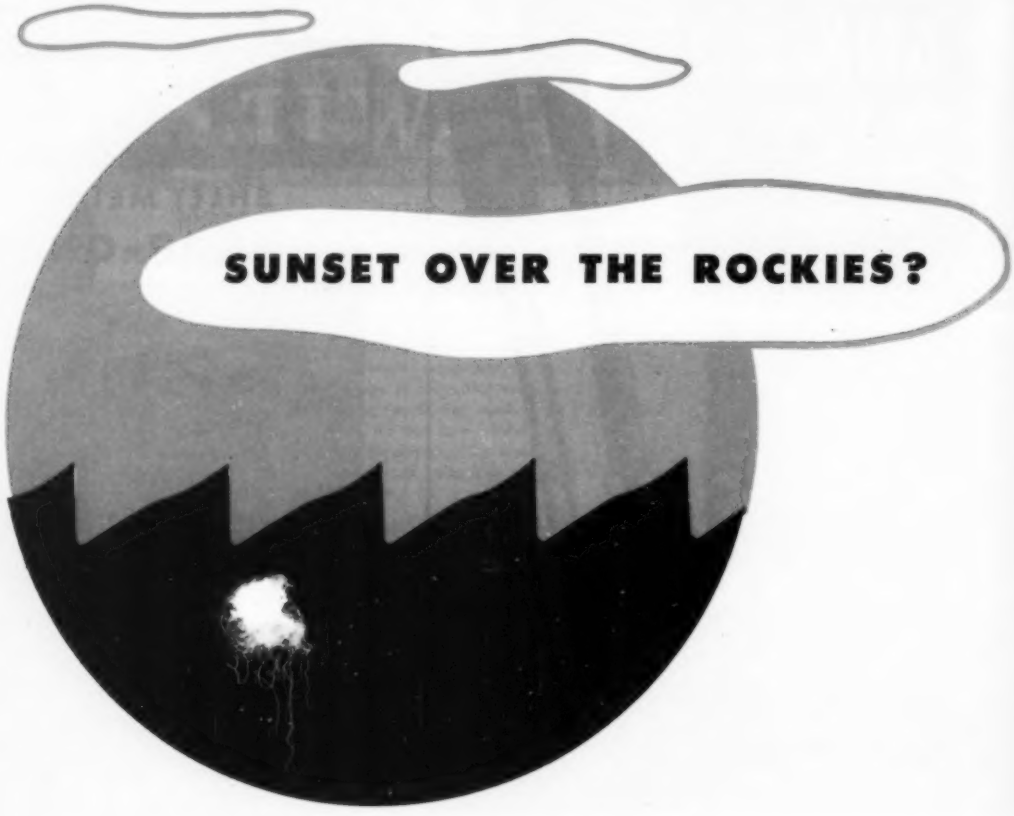

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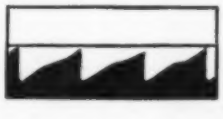

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The present as well as past issues of INDUSTRIAL ARTS AND VOCATIONAL EDUCATION contain much information in its advertising pages which will be of great assistance to the instructor who is confronted with the task of making out requisitions for the school year 1950–51.

This task of requisitioning tools and equipment requires study and sober judgment. If the proper records have been kept, it will be relatively simple to make the needed computations and then write out the required requisitions. But, remembering our usual frailties, those records, no doubt, lack clearness and completeness.

To get your quantities correct then may call for some extra work, but the advertising pages in INDUSTRIAL ARTS AND VOCATIONAL EDUCATION will show you how to specify what you want, and where you can get it.

Lest You Forget

For your convenience, the following list is repeated here to help you make your selection of the summer school you wish to attend during the coming vacation.

Bradley University (Bennett College), Peoria 5, Ill. June 14–July 20, July 21–August 24.

Colorado A. & M. College, Fort Collins, Colo. June 19–July 14, and July 17–August 11.

Cornell University, Ithaca, N. Y. July 3–August 12.

Oregon State College, Corvallis, Ore. June 19–August 11.

Oswego State Teachers College, Oswego, N. Y. July 5–August 11, July 5–28, July 31–August 25. Driver Training, August 21–September 1.

Pennsylvania State College, State College, Pa. June 13–30, July 5–August 11, August 14–September 2.

Southern California, June 26–August 4, August 7–September 1.

The Stout Institute, Menomonie, Wis. June 19–July 28.

Texas A. & M. College, College Station, Tex. June 5–July 15, July 17–August 25.

University of Minnesota, Minneapolis 14, Minn. June 12–July 22, July 24–August 26.

Wayne University, Detroit 1, Mich. Six, eight, or ten weeks, starting June 26.

This Month's Cover

The cover picture for this month's issue of INDUSTRIAL ARTS AND VOCATIONAL EDUCATION shows an operator testing a shaft mounted between the centers of a lathe. The dial indicator button rests on the shaft near the center. As the operator revolves the lathe spindle by hand, the dial indicator will show inaccuracies of straightness or concentricity. Photograph, courtesy of The South Bend Lathe Company.

Coming Conventions

Apr. 20–22. **Michigan Industrial Education Society,** at Grand Rapids, Mich. Secretary, Maurice C. Overholt, 316 S. Fifth St., Grand Haven, Mich.

Apr. 21–22. **West Virginia Branch, American Vocational Association,** at Jackson's Mill, W. Va. Headquarters, Mt. Vernon Hall. Secretary, Dwight Fowler, Bridgeport, W. Va.

Apr. 21–22. Fourth annual conference of the **Louisiana Industrial Education Conference,** at Natchitoches, La. Headquarters, Northwestern State College. Secretary, Walter J. Robinson, professor of industrial education, Northwestern State College.

Apr. 27–29. **Indiana Industrial Education Association,** at Marshall, Ind. Headquarters, Turkey Run Inn. Secretary, H. G. McComb, 215 State House, Indianapolis, Ind.

May 4–6. **American Association for Adult Education** at Cleveland, Ohio. Headquarters, Hotel Hollenden. Secretary, Miss Mildred V. D. Mathews, 167 Public Square, Cleveland 14, Ohio.

May 4–6. **Wisconsin Association for Vocational and Adult Education** at Green Bay, Wis. Headquarters, Hotel Northland. Secretary, C. D. Rejahl, Green Bay School of Vocational and Adult Education.

May 5–6. **Texas Vocational Association** at Galveston, Tex. Headquarters, Buccanner Hotel-Marine Pier. Secretary, Miss Esther Sorensen, Tech Station, Lubbock, Tex.

May 11–13. **American Industrial Arts Association** at Cincinnati, Ohio. Headquarters, Netherlands Plaza Hotel. Secretary, D. Arthur Bricker, 216 E. 9th St., Cincinnati, Ohio.

VOL. 39, NO. 5 MAY, 1950

Industrial Arts and Vocational Education

THE SHOP TEACHERS' PROFESSIONAL MAGAZINE

THE BRUCE PUBLISHING COMPANY
400 N. BROADWAY, MILWAUKEE 1, WIS.

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Articles Indexed. — The articles contained in the Magazine are regularly indexed in "The Readers' Guide to Periodical Literature," and "Education Index."

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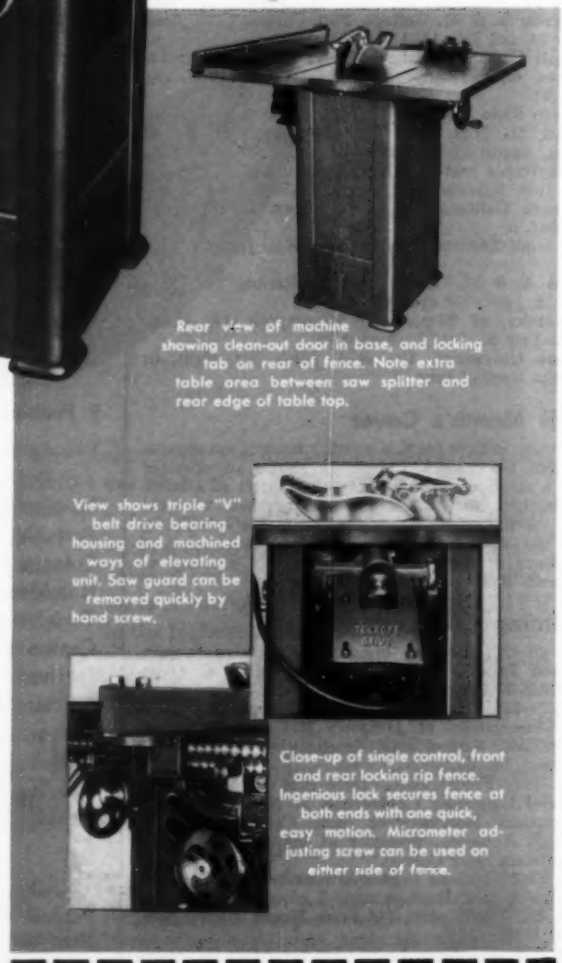

Rear view of machine showing clean-out door in base, and locking tab on rear of fence. Note extra table area between saw splitter and rear edge of table top.

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-IAVE-
MAY . . . 1950

Our Evolving Philosophy of Industrial Arts

ROBERT A. HARDIN
Chairman, Department of Industrial Education
University of Oklahoma
Norman, Okla.

A few years ago Dr. Boyd H. Bode made the statement that "If industrial arts is to make good its claim to equality (with traditional school subjects) then it must set up a specific standard of values. To fall back on 'worthy experiences' is simply to evade the issue."

"Up to the present time the newer movement in education to which industrial arts belongs has not set any standard worthy of the name."[1]

I am going to attempt to show that we do have standards of values; we have a very clear and definite philosophy of industrial arts which has gradually evolved from basic concepts as modes of living and thinking have evolved about us. This philosophy does not necessarily differ from the standards adopted for general education. Even though this philosophy and its interpretation into methods and practices may be obscure to many of us, our leaders in the field of industrial arts had it very definitely in mind when "manual training" was first introduced into the curriculum of the secondary school.

This basic philosophy of industrial arts has been included in writings from the beginning of written history, and even has existed from the time when prehistoric man left the forest to make his first timid foray through the grasses of the plains. From that time on, one of the most important purposes in the educational life of man has been "how to earn a living."

[1]See footnote references at end of this article.

We even had diversified occupations before the dawn of history. Men had to learn three things: how to hunt, how to fight, and how to cultivate the soil. They did not then need to know how to make clothes, how to cook, or how to build houses. These crafts were later forced on them by discoveries and developing social conventions.

Boys learned those three basic occupations from their fathers or from the chiefs of the tribe. They had to learn them well in order to compete with others and with rival tribes. They even had related subjects then because it was necessary to learn what wood was best for bow or arrow, and what stone was best for spear and arrowheads.

Basic Philosophy of Industrial Arts

We have always had a basic philosophy of industrial arts. It is and always has been *the welfare of the common man.* The first important discovery of the human race was fire. This was probably purely accidental, but because of the discovery, education in the arts and crafts assumed a greater importance. As fire brought about subsequent discoveries, man learned the occupations of miner, smelter, smith, builder, and as this pyramiding of discoveries and occupations grew, so also learning how to do things became more and more necessary in order for man to compete with his neighbors. He who could make the best implements became more well-to-do than his fellows and so was set apart from others not so skilled or well informed. He who could fight the fiercest was able to capture the most slaves and so became a wealthy landowner because he had them to do his work for him. But the landowner was in the minority. A much larger percentage of the people of the world were, then and now, the common men. Many of the common people are common because intellectual, emotional, and physiological traits make them so. Others are common by chance.

One outgrowth of this early manifestation of individual differences was the tendency to look down upon the common man — he who worked with his hands, but the works of the philosophers, Socrates, Bacon, Locke, and others are rich with arguments for education in the arts and crafts for the well-to-do and commoner, alike. For the well-to-do, that he might have a better understanding of the common man and an occupation by which he could make a living if necessary. For the common man that he should be better enabled to maintain and improve his station in life.

We are prone to think of industrial arts as a new area in education, but it is not. It is the oldest form of education known to man. Industrial arts antidates academic instruction by many thousands of years, but did not become a part of what later was called formal school education because, for many centuries, education was not for the masses but for the sons of princes, lords, and wealthy landowners. Learning in skills passed from father to son by imitative processes. Many writers on industrial arts quote educational philosophy as far back as the Renaissance, but documentary evidence of practical or useful education dates back almost 4000 years. Stone tablets excavated at Ur in Chaldea revealed laws under which young people learned how to do things. "The Code of Hammurabi provides another example of early practices. Such laws were perfectly natural because the idea of 'industry' or work is as old as civilization itself."[2]

A great deal of what we now term the culture of the past grew out of the efforts of those skilled with their hands. King Solomon's temple was beautified and adorned by one who was regarded as the most skilled and accomplished artist of

that time. Much of the beauty and artistry of bookmaking emerged from the laborious handwork of the monks in the monasteries of the middle ages. All famous works of art were executed by hand. Progress in science and industry has depended greatly upon contributions of individuals working with their hands. The culture of the future lies in the handiwork of the present and he who is skilled in the arts and crafts is building the culture of the future.

We have said that philosophers throughout history have argued convincingly for training in handwork. Some of them even mention the term "Manual Arts." The writings of early educational leaders, too, are redolent with references to industrial arts.

Older Philosophers Who Advocate Handwork

We are all familiar with the seven cardinal principles of secondary education formulated about 30 years ago by the N.E.A. and the more recent standards of attainment. Some of these standards have to do with vocational guidance, general educational values, handyman abilities, appreciation, consumer values, use of leisure time and others. There is strong evidence that many of the writers of the sixteenth, seventeenth, and eighteenth centuries advocated some of these principles with particular reference to the part industrial arts could play. John Amos Comenius (1592–1670), an educational writer of the seventeenth century, said some things which sound a great deal like vocational guidance. He said (speaking of the kindergarten age) "Let them be like ants, continually occupied in doing something, carrying, drawing, constructing and transporting, provided always that whatever they do be done prudently. . . . They are delighted to construct little houses, and erect walls of clay, chips, wood, or stone, thus displaying an architectural genius."[3] Nearly a century later we find that Sir William Petty saw the same value in handwork. He advocated writing a book which would lay open the mysteries of the trades so that boys, when they were bound out as apprentices, might select an occupation in which they would be interested.[4]

We also find evidence centuries old that appreciation formed a part of the philosophy of handwork. Comenius wrote concerning children of six to twelve years of age, "They should learn the most important principles of the Mechanical Arts, both that they may not be too ignorant of what goes on in the world around them and that any special inclination towards things of this kind may assert itself with greater ease later on."[5] This quotation sounds as though he had appreciation in mind as well as vocational guidance. From the foregoing it seems that educational writers thought about a philosophy of industrial arts at least 300 years ago. Worthy use of leisure was one value John Locke (1632–1704) saw in handwork. One of the reasons why he advocated learning the manual trades was "because they provide diversions or recreations"[6] Nearly two hundred years later a whittling school was opened in Boston with Frank Rowell as the teacher in which "The chief value of the instruction was said to be not in the amount of skill gained by the boys but in the bent it gave to their leisure hours."[7]

We can trace the aim of consumer appreciation back as far as Sir William Petty who wrote a pamphlet in 1647 on education. In this pamphlet he advocated that all children be taught some one of the manufacturing arts in order that, among other things, "They will be less liable to be cheated by artificers."[8]

With the exception of the teaching of drawing, educational thought and philosophy of the sixteenth and seventeenth centuries bore little fruit as far as getting industrial arts into the school curriculum was concerned. One exception worthy of note "is found in the case of Erhard Weigel (–1699) of Jena, whose work seems to have been a link between Comenius and Froebel."[9] He wished the children to use blocks of wood and to make models and figures out of paper in order to "sweeten" the process of learning.

Jean Jacques Rousseau, an educational reformer about the middle of the eighteenth century, wrote extensively about realism in education. His writings later had some influence on the development of industrial arts. He would have had every boy learn a trade, not merely for the sake of knowing how to use it but that "he may overcome the prejudices usually conceived against it."[10] One of the basic principles of industrial arts today is concerned with developing an appreciation of one's fellow men.

Of all the educational writers, those who made the greatest contributions to industrial arts up to the first quarter of the nineteenth century were Pestalozzi and Fellenberg. The two men worked together at times on educational projects and schemes, Fellenberg furnishing the money, and Pestalozzi the thought and practice which grew out of the latter's earlier attempts to make "work experience" pay the children's way in school.

Pestalozzi felt that academic work and manual work should go hand in hand. He tried to connect study with manual labor and to make one thing of the school and the workshop, and made progress in using objects and manual labor as a means of teaching the traditional school subjects. That he was not more successful in promoting his type of school was due in part to his lack of administrative ability. He was interested in the poor boy and believed, as did Fellenberg and others at that time, in three classes in society, the upper, middle, and lower. He tried to educate and train boys and girls of this lower class to make the most of the opportunities the economic world permitted them, believing that it was not well for them to seek employment above their station. This idea dominated the schools of Europe and, in this respect, European writers lagged far behind in their philosophy. It remained for America later to demonstrate that a poor boy could attain the highest office in the land or become the richest man in the nation.

To Fellenberg we give credit for having the administrative ability to put into effect the theories of Rousseau and the experiments of Pestalozzi. The various manual labor and farm schools which he established dominated the arts and crafts picture until about the year 1870, when others began to subject handwork to a critical job analysis and to organize this field for instruction on a basis comparable to academic work. Prior to that time all manual labor was taught by imitative processes closely akin to apprentice training. Skills and trades were passed from father to son or were learned through some sort of apprentice system. It was quite generally believed that they could not be organized for instructional purposes.

The development of handyman abilities is not a product of modern educational thought. We see this aim advocated by Augustus Herman Niemeyer in the year 1799 who wrote "Above all, it is well that the young should become familiar with the ordinary tools of a household, of which, moreover, one has such constant need; for example, the saw, ax, gimlet, hammer, etc. To keep these things anxiously out of the children's reach is the most certain way to reduce to helplessness. . . ."[11] This aim was one of the most important advocated by Cygnaeus nearly a hundred years later in his plans for educational Sloyd in Finland.[12]

Today no teacher should think of industrial arts except as an integral part of general education. Precedent for this thought is found in the works of many educational writers. In 1797 Heinrich Gottlieb Heusinger wrote a pamphlet in which he advocated utilizing the child's desire for

activity. Two points which he emphasized were: (1) that the work should not be merely a foundation for artisan's work, but for general education; and (2) that the materials used should be as various in character, and furnish as great variety in the forms of objects, as possible.[13]

Herbart, one of the world's greatest educational philosophers, believed that handwork was a necessary part of general education. He said "Elementary schools should have workshops, though they should not actually be technical schools. And every man should learn to use his hands. The hand holds the place of honor at the side of the power of speech in raising man above the beasts."[14] Refering again to Cygnaeus, "All of these kinds of work shall not be conducted like a trade but always with reference strictly to the universal educational aims."[15]

Earlier Attempts in America

A few attempts were made in America prior to 1870 to promote handwork in the schools. At about this time something began to happen to our philosophy of industrial arts. Heretofore, practically all manual instruction had as its sole purpose teaching the boy how to earn a living. It would not be quite correct to speak of a "change" in the philosophy because we still hold to "vocation" as one of our aims. We began to add to it, and to recognize aims of general educational value such as use of leisure, worthy home membership, consumer appreciation, etc., which had been emphasized by Comenius, Petty, Pestalozzi and others.

Methods in "manual training" too, began to undergo a change. An important impetus to the development of methods was given us by Victor Della Vos when Woodward, Runkel, and others adapted his methods to American use, and thereby introduced into this country what is now referred to as the first period in the development of industrial arts in secondary education, the "manual training" period.

Vos had subjected hand and machine work to a job analysis so that the work could be taught in a systematic way to groups as well as to individuals. Some of the aims of "manual training" as adapted to use in American schools indicate the direction our philosophy was taking at that time. As summarized recently by Erhard F. Wendt[16] they are as follows: (1) By furnishing an outlet for the constructive impulses, it supplied what so far had been lacking in general education. (2) It made school training more purposeful. People could recognize a more definite relationship between school and industry. Leaders in the movement however, never did believe that it would replace vocational training. (3) The cultivation of habits of industry was felt to be very important. (4) Manual training in the schools was expected to develop a respect for the manual laborer and so raise the status of the working class. It does not require a very liberal interpretation to see in this statement of aims many of the objectives which we now recognize as guiding principles in industrial arts.

As is always to be expected when a change in educational practices is proposed, the newcomer is batted around for a few years before being accepted by school administrators and the public. The period from 1880 to 1900 might be called a transition period in industrial arts. It was the period when, as previously stated, leading men in industrial arts were carrying on the battle on the argumentative front in state and national meetings for industrial arts as a part of the general educational program.

The opposition brought forth all sorts of arguments against this intruder of their cultures. For instance A. P. Marble, then superintendent of the public schools, Worcester, Mass., said, "There is no information stored up in the plow, hoe handle, steam engine, but there is information stored up in books."[17] For the defense, Dr. Woodward said, "The obscurities of the textbooks . . . vanish before the steady gaze of a boy whose hands and eyes have assisted in the building of mental images."[18] And Dr. Felix Adler adopted the view that "tool instruction, workshop lessons in a word, technical training and artistic modeling — are essential elements of general culture. . . . I should plead for it then, as now, simply because of its broadening humanizing effect; because it quickens into activity certain faculties of human nature which too commonly lie dormant; because, instead of the present one sided development, it is a step further in the direction of that all-sided development which is the ideal of education."[19]

It is not to be expected, however, that promoters of manual training avoided all the pitfalls into which other educators fell. One prevalent philosophy of education at that time constituted one such pitfall. It was the disciplinary theory of education. Some men claimed more disciplinary values for manual training than it possessed. Even Dr. Nicholas Murray Butler in defending manual training said, "If shopwork is used as a means of manual training, it is because of its disciplinary value, not because of its utility. . . . If the term manual training is used in antithesis to mental training it is wrongly understood. Manual training as I use the term, is mental 'training.' "[20]

Controversies Between Industrial Arts and Vocational Education

Another pitfall was vocational education. Some of those who could not see in manual training the cultural and aesthetic values it possessed, thought that it would provide vocational preparation that would enable a boy to work at a trade upon finishing school. Although few of those whom we now call leaders in this field held this view, it is strange how this idea still persists in the mind of the general public. We still meet stanch citizens who look upon industrial arts with scorn because a boy cannot frame a roof after having had one year of woodwork in the ninth grade.

It is probably true, however, that the controversy between vocational and manual training theories served a valuable purpose in helping to direct our evolving philosophy into the definite channel of general education. During this period of controversy there was a great deal of opposition to vocational education at public expense. It was quite generally felt that industry should pay for such training. However, the breakdown of the apprentice system and rapid industrial expansion about this time placed the responsibility of vocational education upon the schools. This development helped direct the attention of promoters of vocational education away from the new manual training schools, and perhaps relieved manual training teachers of the responsibility of filling the dual role of vocational and general education.

We do not now, of course, assign any more disciplinary values to industrial arts than to any other school subject. Nor do we claim any important vocational values except guidance and prevocational training even though some boys do learn enough in the school shop to enable them to gain employment with a year or two of credit in apprenticeship when they finish high school. These two ideas now have little place in our philosophy, but perhaps may have aided industrial arts in gaining the foothold in general education which has enabled it to grow steadily in importance during the past half century. The controversy had one bad influence on industrial arts, however. It placed leaders in the field on the defensive and the tendency was to stay on it too long. Until a few years ago, it was very common to pick up one of our professional periodicals and see an article entitled "Justification of Industrial Arts." We no longer need to justify industrial arts in our own minds and we owe a debt of eternal gratitude to Woodward, Russell, Bennett, Richards, and others for fighting the philosophical battle for us. During all this imagined

conflict in philosophies of industrial arts and general education, the fundamental purposes of this new area of education were kept clearly in mind by these leaders even though it was not always clear as to how the objectives were to be attained. Some of the rest of us have not been nearly as brilliant in interpreting this philosophy and putting it into practice.

We do not have the space here for a general outline of industrial arts history from 1900 to the present day. We all are aware of the rapid growth of shopwork in our public schools. But we should know something of the philosophy of the period in order to know how industrial arts evolved from the field of special subjects into the realm of general education.

We find a notable change taking place in manual training theory during the period 1880–1900. It is of course to be expected that teachers could not look ahead far enough to see the value of projects in teaching when manual training was first introduced. Most of the teaching was done by exercises, particularly in woodwork which was organized around the making of a series of joints. Dr. Woodward, in his woodworking course at St. Louis, listed 22 joints and tool operations as the basis of the course. The manual training school at St. Paul, Minn., under the direction of Charles A. Bennett, represented what was perhaps the first notable deviation from this rigid exercise system. Bennett says of this school that "some progress was made toward flexibility in the organization of shop and drawing courses to meet the needs of pupils of varying interests and abilities. This led to the introduction of completed useful problems and projects after a few fundamental tool exercises."[21] We see in this statement one of the first progressive attempts to provide for individual differences in the school shop and the beginning of the second period of industrial-arts development in America, the "Manual Arts" period.

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(*To be continued*)

Industrial-Arts Drafting Course Based on Student Interests*

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The students who elect drafting in the Pueblo, Colo., high schools are typical of pupils in many American communities. Comparatively few engage later in drafting as a vocation or continue the subject in college. It would appear, therefore, that high school courses for these pupils should be directed toward their needs as young people, parents, and citizens, rather than as prospective commercial draftsmen.

In many school situations there has been too little attempt made to make instruction practical and useful. Practices in drafting classes have as a rule been particularly backward. Altered conditions of living and scientific advances have in many cases failed to show their effects on the curriculum.

Sources of Data

It was decided to develop a course in drawing for the ninth and tenth grades, which was based on an objective study of student interests and needs, rather than upon tradition or a convenient textbook. Data were obtained from three sources: students, parents, and teachers. The study was conducted between September, 1946, and May, 1947.

One hundred forty-eight ninth- and tenth-grade boys enrolled in drawing at the two Pueblo, Colo, high schools, and who had completed one semester of the subject supplied information on a questionnaire. They were asked: (1) to indicate which of 21 drawing skills they used frequently, seldom, or never in school, in carrying on their hobbies, or in their work about the home; (2) to indicate three reasons why they had elected drawing; (3) to select a first, second, and third choice from a list of 13 fields of drawing that they would be interested in taking;

*Based upon the Master's Report: "A Course in Drawing for the Pueblo Schools" by Joseph S. Chick, Colorado A. & M. College, 1947.

(4) to list their hobbies, exclusive of sports.

Ninety-four parents or guardians of the above students answered the questionnaire on the 21 drawing skills. They were asked also to list the hobbies of their boys, and to check 5 of a list of 12 habits, attitudes, and appreciations which they felt would contribute most toward helping the students to become happy and useful adults.

The teachers, seventy in number, of the boys also were asked to offer their opinions on the importance of the 21 drawing skills. Like the parents, they selected also 5 of the list of 12 habits, attitudes, and appreciations which contribute most toward helping the students to become happy and useful adults.

The occupations of the 94 parents were distributed among 45 heads. Of the group, 18 were housewives, and 14 were steel workers.

Fifteen of the 70 teachers taught English, 10 taught mathematics, and the remainder were distributed among other departments. Eighteen of the group had taken some instruction in drawing, while the remainder had no training.

What Should Be the Aims of the Course in Drawing?

The teachers and parents selected 5 out of a list of 12 aims which they felt would contribute most toward helping the students to become happy, useful, and satisfied adults. Aims other than those listed could be written in. The results appear in Table I.

It is interesting to note that parents ranked "The Habit of Careful and Thoughtful Work" first, and it took second rank with teachers. It will be seen that there is a fairly close relation between the parents and teachers in ranking the importance of the aims. If the aims ranking higher than ninth by both parents and teachers are accepted as being of the greatest importance, then a list numbering seven results. The list includes:

1. An appreciation of good workmanship in drawing
2. An attitude of pride in the ability to execute a good drawing
3. Self-reliance and confidence
4. The habit of using an orderly method of procedure
5. The habit of careful and thoughtful work
6. A co-operative attitude
7. The power of visualization

It can be seen that parents and teachers hold attitudes to be just as important as mechanical skill.

What Kinds of Drawing Skills Are Needed?

Students, teachers, and parents voted on the kinds of drawing skills needed by ninth- and tenth-grade drawing students. They were asked to indicate whether each skill from a list of 21 was thought to be needed *frequently*, *seldom*, or *never*. The results are shown in Table 2.

Surprisingly, all three groups agreed in placing number 9 in the list, *lettering*, as being the most important skill. The tabulations were ranked, giving the *seldom* and *never* categories inverse ratios. The more votes received by items in these categories, the less important they were inferred to be. Items ranking in the upper two thirds (first 14 of the 21) in two of the three categories are shown in Table 3.

Items were finally selected if they were

TABLE 1. Aims Contributing Most Toward Helping Students to Become Happy and Useful Citizens

Aim	*Parents Checking*		*Teachers Checking*	
	Number	*Rank*	*Number*	*Rank*
1. An active interest in drafting and the drafting occupations	39	7	15	10
2. Ability to select wisely drafting materials and tools	20	12	4	12
3. An appreciation of good workmanship in drawing	39	6	26	7
4. An attitude of pride in his ability to execute a good drawing	46	3	23	8
5. Self-reliance and confidence	50	2	43	3
6. The habit of using an orderly method of procedure	45	4	52	1
7. The habit of self-discipline	31	10	36	6
8. The habit of careful and thoughtful work	68	1	47	2
9. A co-operative attitude	32	4	36	5
10. Skill in the use of drawing tools	38	8	18	9
11. The habit of making things pleasant and easy for others	20	11	10	11
12. The power of visualization	42	5	37	4
13. Others	0		3	
Total individuals reporting	94		70	

TABLE 3. Items in Drawing Ranking in Upper Two Thirds of Two Out of Three Categories by Boys, Parents, and Teachers

Boys	1	2	3	4	5	*	7	8	9	*	*	*	13	14	15	*	17	*	19	*	21
Parents	1	2	3	4	5	*	7	8	9	*	*	*	13	14	15	*	17	*	19	20	21
Teachers	1	2	3	4	*	6	7	8	9	10	11	*	*	14	15	*	*	18	19	20	21

*Does not rank in upper two thirds of two out of three categories.

TABLE 2. Kinds of Drawing Skills Needed by Students as Indicated by Drafting Students, Parents, and Teachers

	Students Checking			*Parents Checking*			*Teachers Checking*		
	F	*S*	*N*	*F*	*S*	*N*	*F*	*S*	*N*
1. Making freehand pictorial sketches	67	69	12	43	41	10	18	24	28
2. Making mechanical pictorial sketches	81	54	13	44	34	16	16	25	29
3. Making freehand orthographic sketches	45	65	38	30	44	20	9	19	42
4. Making mechanical orthographic drawings	61	61	26	33	37	24	6	22	42
5. Making sectional drawings	39	75	34	23	41	30	5	18	47
6. Drawing electrical diagrams	26	37	85	16	28	50	4	5	61
7. Making charts and graphs	35	77	36	23	44	27	22	24	24
8. Making notebook or other covers	41	86	21	33	45	16	14	22	34
9. Lettering neatly and well	98	46	4	60	29	5	29	22	19
10. Making maps	20	83	45	19	46	29	8	27	35
11. Making floor plans	30	43	75	19	42	33	6	16	48
12. Drawing front and side views of buildings	26	49	73	21	34	39	5	10	55
13. Inking lines with ruling pen or compass	56	49	43	27	31	36	3	23	44
14. Reproducing a drawing	44	63	41	29	38	27	13	28	29
15. Transferring or enlarging a pattern	35	55	58	26	37	31	8	20	42
16. Making folded object forms	27	64	57	17	38	39	3	9	58
17. Reading orthographic drawings	37	73	38	32	35	27	7	14	49
18. Reading electrical diagrams	32	45	71	20	32	42	6	8	56
19. Reading charts and graphs	42	87	19	32	44	18	29	20	23
20. Reading floor plans	28	65	55	25	42	27	5	22	43
21. Reading maps	57	74	17	39	41	14	19	23	28
Total individuals reporting	148			94			70		

ranked by two of the three groups. This meant that items 6, 10, 11, 12, 16, and 18 did not qualify. The course of study was finally based on the following list of skills:

1. Drawing free hand pictorial sketches
2. Making mechanical pictorial drawings
3. Making freehand orthographic sketches
4. Making mechanical orthographic drawings
5. Making sectional drawings
6. Making charts and graphs
7. Making cover designs
8. Lettering neatly and well
9. Inking lines with ruling pens or compass
10. Reproducing a drawing
11. Transferring or enlarging a pattern
12. Reading orthographic drawings
13. Reading charts and graphs
14. Reading floor plans
15. Reading maps

Student Drawing Interests

When the students were asked why they elected drawing, they were asked to select a first, second, and third choice from a list of eight, or others that they cared to add. The results are shown in Table 4.

A total of 106 or 71.6 per cent boys indicated as a reason for taking drawing that they may take architecture, art, aviation, or engineering in college. Inasmuch as only an estimated 21 per cent of the boys being graduated from the Pueblo high schools enter college, this choice does not appear to be very realistic. It might, however, be given consideration because of its possible value in the motivation of instruction. There may, on the other hand, be implications pointing toward the need for better pupil guidance.

To try drawing as an aid in deciding life's work was given as first, second, or third, choice by 103 or 69.6 per cent of the boys. This would seem to suggest that the exploratory objective of industrial-arts drafting be given strong consideration. General culture, preparation for a vocation, and aiding in craft work, also ranked high in the voting.

The 148 students were asked also to indicate first, second, and third choices from a list of 13 fields of drawing which they would be interested in taking if they were offered. The results are shown in Table 5.

It will be seen that architectural, aeronautical, machine, and structural drawing are the fields which have the greatest interest to students.

The hobby interests of the students were grouped under the heads shown in Table 6. These choices coincided to a considerable degree with the hobbies as observed by their parents.

The high degree of interest shown in model making indicates the desirability of devoting attention to the reading and interpretation of this type of drawing.

Suggested Course Outline

It is recognized that the immediate apparent needs and interests of students cannot form the only basis for the construction of a course of study. While interests at the ninth- and tenth-grade levels are relatively more stable and have a greater chance of surviving than those of younger people, some are likely to die out and be replaced. Future as well as present needs must be considered. Since boys are comparatively limited in experience, they are not capable of recognizing all their needs.

In preparing the course outline, attention was given to the student needs and interests as indicated by parents, students, and teachers.

TABLE 4. Why Students Elect Drawing

Reason	*Student Choice* 1st	2nd	3rd	Total
1. As an aid in deciding life's work	36	30	37	103
2. As an aid to working in father's business	1	7	3	11
3. To serve immediate needs in design and construction of craft work	11	13	15	39
4. To qualify as a draftsman	21	23	18	62
5. May take architecture, art, aviation, or engineering course at college	51	35	20	106
6. To teach drawing in the future	2	7	7	16
7. General culture such as skill, neatness, and ability to visualize	23	29	37	89
8. For school credit	3	4	10	17
9. Others	0	0	1	1

Total students reporting: 148

TABLE 5. Fields of Drawing Which Interest Students

Fields of Drawing	*Student Choices* 1st	2nd	3rd	Total
1. Machine drawing	31	19	20	70
2. Architectural drawing	46	18	15	79
3. Aeronautical drawing	28	29	21	78
4. Map drawing	8	15	13	36
5. Charts and graphs	0	0	1	1
6. Piping drawing	0	5	2	7
7. Electrical drawing	13	10	5	28
8. Freehand sketching	5	13	5	23
9. Pictorial drawing	3	3	9	15
10. Sheet-metal drawing	0	4	5	9
11. Student drawing	5	15	21	41
12. Woodshop drawing	4	11	9	24
13. Blueprint reading	5	6	22	33

Total students reporting: 148

TABLE 6. Hobbies of 148 Students in the Pueblo, Colorado, High Schools

Type of Hobby	*Number Indicated*
1. Model making	76
2. Drawing activities	33
3. Electrical activities	18
4. Mechanical activities	18
5. Woodworking activities	10
6. Photography	10
7. Outdoor activities	13
8. Collecting	9
9. Craftwork	4
10. Aviation activities	6
11. Miscellaneous activities	20

COURSE OUTLINE

Unit No.	*Name of Unit*	*Teaching Device*
I	Value of mechanical drawing	*a*) Lecture *b*) Information sheet *c*) Oral questions
II	Description, use, and care of drawing instruments	*a*) Lecture *b*) Information sheet *c*) Film strip *d*) Oral questions
III	Constructions 1. How to bisect a straight line or arc 2. How to bisect an angle	

Unit No.	*Name of Unit*	*Teaching Device*
	3. How to pass an arc through three points	*a*) Film strip *b*) Operation sheets *c*) Quick drawings on newsprint
	4. How to divide a straight line into any number of equal parts	
	5. How to draw an arc in a right angle	
	6. How to draw an arc tangent to two nonparallel lines	
	7. How to draw an arc tangent to a straight line and a given arc	
	8. How to draw an arc tangent to two given arcs	
	9. How to transfer plane figures	
	10. How to draw a triangle when three sides are given	
	11. How to draw a regular octagon	
	12. How to construct a hexagon	
	13. How to construct any polygon	
	14. How to draw an ellipse	
	15. How to draw parallel lines	
IV	Angles obtained by combination of triangles	*a*) Operation sheet *b*) Test sheet *c*) Film strip
V	Alphabet of lines	*a*) Information sheet *b*) Test sheet
VI	Orthographic projection	
	1. Theory of orthographic projection	*a*) Film slide *b*) Screen box
	2. 2-view orthographic drawing	*a*) Job sheet *b*) Freehand sketch *c*) Mechanical drawing
	3. 3-view orthographic drawing	*a*) Job sheet *b*) Freehand sketch *c*) Mechanical drawing
	4. 3-view orthographic drawing involving hidden lines	*a*) Job sheet *b*) Freehand sketch *c*) Mechanical drawing
	5. 3-view orthographic drawing involving foreshortened lines	*a*) Job sheet *b*) Freehand sketch *c*) Mechanical drawing
	6. 3-view orthographic drawing involving arcs and circles	*a*) Job sheet *b*) Freehand sketch *c*) Mechanical drawing
VII	Lettering	*a*) Blackboard *b*) Information sheet *c*) Lettering plates
VIII	Dimensioning	
	1. General rules	*a*) Blackboard demonstration *b*) Information sheets *c*) Oral questions
	2. How to dimension arcs and circles	*a*) Blackboard demonstration *b*) Oral questions
	3. How to dimension small spaces	*a*) Blackboard demonstration *b*) Oral questions
	4. How to letter notes	*a*) Lecture *b*) Models *c*) Test
IX	Working drawings	
	1. Meaning and use	*a*) Lecture *b*) Oral questions
	2. Problems	*a*) Job sheet *b*) Drawing plates
X	Drawing layout	
	1. How to determine position in which to draw object	*a*) Demonstration *b*) Oral questions
	2. How to balance a drawing	*a*) Operation sheet *b*) Quick problem
	3. How to determine the number of views	*a*) Lecture *b*) Oral questions
	4. How to pencil a drawing in proper order	*a*) Lecture *b*) Models
XI	Detail and assembly drawings	
	1. Meaning and use	*a*) Information sheet *b*) Oral questions
	2. How to make a detail drawing. Problem	*a*) Job sheet *b*) Drawing plate
	3. How to make an assembly drawing. Problem	*a*) Job sheet *b*) Drawing plate
XII	Projection aids	
	1. Visualizing	Lecture
	2. Ground line	*a*) Lecture *b*) Demonstration
	3. Locating points	Lecture
	4. Problems	Drawing plates
XIII	Exercises	
	1. Missing-view exercises	Drawing plates
	2. Matching pictorial to orthographic	Matching test
XIV	Sections	
	1. How to draw full sections	
	2. How to draw half sections	Blackboard lecture
	3. How to draw revolved sections	
	4. How to draw removed sections	
	5. Problems	Drawing plates
XV	Auxiliary views	
	1. Need for	*a*) Lecture *b*) Assignment sheet *c*) Drawing plates
	2. Problems	
XVI	Design and draw original problem	
	1. Detail	Drawing plate
	2. Assembly	
XVII	Map reading	
	1. Kinds of maps	*a*) Information sheet *b*) Miscellaneous maps *c*) Stereopticon
	2. Practice reading	
XVIII	Reading charts and graphs	
	1. Description and use	*a*) Information sheet *b*) Misc. charts and graphs *c*) Stereopticon
	2. Reading	
XIX	Making charts and graphs	
	1. Line graphs	
	2. Bar graphs	
	3. Pie chart	*a*) Information sheets *b*) Original data *c*) Drawing plate
	4. Problems	

Unit No.	*Name of Unit*	*Teaching Device*
XX	Inking	
	1. Inking aids	Information sheet
	2. Use and care of tools	Information sheet
	3. How to sharpen a ruling pen	Operation sheet
	4. Proper order of inking	Information sheet
	5. Practice exercise	Drawing plate
	6. Problems	
XXI	Tracing	
	1. How to make an ink tracing	Operation sheet
	2. Drawing on tracing paper for reproduction	Lecture
	3. Problems	Drawing plates
XXII	Reproduction	
	1. Need for reproduction	Lecture
	2. How to make a blueprint	Operation sheet
	3. How to make a blackline print	Operation sheet
XXIII	Blueprint reading	
	1. Symbols	Information sheet
	2. Titles	Lecture
	3. Machine drawings	*a*) Simple blueprints *b*) Oral questions
	4. Architectural drawings	*a*) Simple blueprints *b*) Oral questions
	5. Airplane drawings	*a*) Simple blueprints *b*) Oral questions
XXIV	Drawing from models	
	1. Use of measuring instruments	Film strip
	2. Machine parts	Drawing plate
	3. Airplane parts	Drawing plate
XXV	Architecture	
	1. Opportunities and requirements	*a*) Information sheet *b*) Field trip *c*) Discussion
	2. History of architecture	*a*) Assignment sheet *b*) Discussion
	3. Architectural orders	*a*) Information sheet *b*) Discussion
XXVI	Architectural drawing	
	1. Architectural lettering	
	2. Architectural symbols	*a*) Job sheets *b*) Drawing plates *c*) Information sheets
	3. Foundation walls and piers	
	4. Joists and sills	
	5. Girders and posts	
	6. Walls and partitions	
	7. Rafters and roofing	
	8. Windows and doors	
	9. Chimneys	
	10. Floor plans	
	11. Elevations	
XXVII	House planning	
	1. Selecting the site	*a*) Lecture *b*) Oral questions
	2. House styles	*a*) Information sheet *b*) Stereopticon
	3. Floor plan	*a*) Job sheet *b*) Drawing plate
	4. Elevations	*a*) Job sheet *b*) Drawing plate
	5. Window and door schedules	*a*) Job sheet *b*) Drawing plate
XXVIII	Pictorial drawing	
	1. Uses and limitations	*a*) Lecture *b*) Drawings from periodicals
	2. Isometric drawing	*a*) Operation sheets *b*) Drawing plates
	3. Cabinet drawing	*a*) Operation sheets *b*) Drawing plates
	4. Perspective drawing	*a*) Operation sheets *b*) Drawing plates
XXIX	Machine drawing	
	1. Opportunities and requirements	*a*) Assignment sheet *b*) Lecture *c*) Field trip
	2. Kinds of fasteners	*a*) Information sheet *b*) Oral questions
	3. Thread forms	*a*) Information sheet *b*) Oral questions
	4. How to draw screw threads	*a*) Operation sheet *b*) Drawing plate
	5. Thread pitches	*a*) Information sheet *b*) Oral questions
	6. How to draw bolts	*a*) Operation sheet *b*) Drawing plate
	7. How to draw cap screws	*a*) Operation sheet *b*) Drawing plate
	8. How to draw machine screws	*a*) Operation sheet *b*) Drawing plate
	9. Threaded holes	*a*) Information sheet *b*) Drawing plate
	10. Methods of forming and finishing holes	*a*) Information sheet *b*) Oral questions
	11. Hub fastenings	*a*) Information sheet *b*) Oral questions
	12. Keys and keyways	*a*) Operation sheet *b*) Drawing plate
	13. Fits	*a*) Information sheet *b*) Oral questions
	14. Limit dimensions	*a*) Information sheet *b*) Oral questions
	15. Detail drawings	*a*) Job sheet *b*) Drawing plates
	16. Assembly drawings	*a*) Job sheet *b*) Drawing plates
XXX	Piping drawing	
	1. Uses and opportunities	*a*) Information sheet *b*) Discussion
	2. Drawing pipe threads	*a*) Operation sheet *b*) Drawing plate
	3. Fittings	*a*) Operation sheet *b*) Drawing plate
	4. Pipe assembly	*a*) Job sheet *b*) Drawing plate
XXXI	Pattern development	
	1. Uses and opportunities	*a*) Information sheet *b*) Discussion
	2. Forming and fabricating	*a*) Information sheet *b*) Discussion
	3. Line of intersection method	*a*) Operation sheet *b*) Models
	4. Triangulation	*a*) Operation sheet *b*) Models
XXXII	Cover designs	
	1. Drawing covers	Models
	2. Note book cover	Original design

The Importance of Skill

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No great nation can hope to survive in this modern age without vast industrial productivity. One of the major factors upon which this productivity depends is the reservoir of skilled workmen with mechanical know-how.

Skill Important During the War

During the war years the importance of even a moderate degree of skill in the use of tools and machines was evidenced by the frantic efforts to train workers for war industries. The War Production Training classes prepared and placed approximately ten million men and women in war industries. For the most part, these workers were trained as operators for jobs requiring skill in a limited number of processes.

In the combat area the ability to operate, repair, and keep in good running order airplanes, tanks, motorized artillery, and other equipment was a big factor in the success of the armed forces of the United States. Officers, on many occasions, have stated that the youths who had previous training in industrial arts and vocational classes quickly adjusted themselves to requirements of mechanical warfare. These experiences, pointing out the need for skilled men and women in times of war, should not be forgotten in times of peace.

Manipulative Skill Not to Be Overlooked

In our anxiety to gain for our students the many values of a well-conducted industrial-arts program, are we neglecting the one value which sets industrial arts apart from most of the other subject fields, namely "manipulative skill"? In all too many school shops, the development of skill appears to have been relegated to a place of minor importance. It is our contention that it should be given a place of major importance; not only for its use in times of war, but for the role it plays in the right kind of education for youth. Witness the boy in the school shop who has developed the skill necessary to shape, join, and assemble materials into a well-designed and constructed article. He takes pride in his craftsmanship; he gains confidence in himself; he has acquired a variety of manipulative skills which make him feel secure in his ability to adjust himself to almost any situation; and should he decide to prepare for a skilled trade, he will be welcomed by the instructor in a vocational class or in an apprenticeship program where his skill will be appreciated and may result in his being given advanced standing.

It is obvious that the teacher himself must be highly skilled if he expects to develop skill in his students. One occasionally sees a highly skilled craftsman who is a failure as an industrial-arts teacher, but one never sees a superior industrial-arts teacher who is not skilled in one or more industrial-arts areas. The possession of skill does not necessarily assure success to an industrial-arts teacher, but without it he is doomed. Nothing is so indicative of good teaching as a shop demonstration skillfully performed. Students admire and respect skilled craftsmanship on the part of their teacher.

Skill Required in the 4 R's

No educator would question the importance of skill in reading, writing, and arithmetic. Why is it then, that the importance of manipulative skill is sometime questioned? Has not man's progress been measured by his skill in the use of tools? It is our contention that manipulative skill should take its place in importance alongside of the three R's. "Man," says Carlyle, "is a tool-using animal. He can use tools, can devise tools; with these the granite mountains melt into light dust before him; he kneads glowing iron as if it were soft paste; seas are his smooth highway, winds and fire his unwearying steeds. Nowhere do you find him without tools: without tools, he is nothing; with tools, he is all. On the physical side, he is the greatest public benefactor who makes the best tools, and he is the best workman who can use tools best."

The tendency of certain industrial-arts teachers to belittle the development of skill is often a "smoke screen" used to cover up poor teaching and the resultant sloppy work produced. One does not expect students in industrial-arts classes to develop a high degree of skill, but it is expected that each student develop a degree of skill in relation to his mental and physical maturity. This is referred to as a reasonable degree of skill.

Of course the development of a reasonable degree of skill is not the only aim of the industrial-arts program, but it is the essential, around which the attainment of other aims is centered. A teacher cannot hope to develop interest, resourcefulness, good work habits, accuracy, appreciation of craftsmanship, joy of accomplishment, and good citizenship if he allows his students to produce work that is poorly designed, constructed, and finished.

The keystone of the industrial-arts program is skill. The enthusiasm with which the boy skillfully attacks the planning and building of something worth while for his home or for recreation is the vehicle which the alert industrial-arts teacher will use to build attitudes, appreciations, and related knowledge. Every youth should experience the thrill and satisfaction of a job well done.

PLEASE NOTE

In the article, "Planning School Shops in Baltimore County, Maryland," by Arthur A. Dick, supervisor, vocational education and industrial arts, Towson, Md., the diagram on page 87 for Grade 9 should show that the student spends 1/3 year in general drawing, 1/3 year in general metals, and 1/3 year in general woodwork.

Fred Tauffenbach, general foreman, tool and die section, Fisher Body Plant, Pontiac Mich., explaining die construction

Industrial Arts and Vocational Education
John J. Metz, Editor

THAT MATTER OF CO-OPERATION

What is co-operation? Where is it supposed to be found in democratic society? What is its purpose? How does it fit into our schools?

Webster gives some plain definitions for this word. He states that the word means "to act or operate jointly with others." Inferentially one may conclude that this operating jointly is to join forces with others to do a better piece of work.

It is quite logical to assume that right minded people would naturally want to co-operate in order to accomplish desired results in an easier way. Democratic society would, therefore, seem to be an excellent demonstration ground for studying and practicing co-operation, since democratic society is based upon the principle of equal opportunities for all.

We hear much of democratic action and yet so many seem to feel that they have greater rights than others. They want the benefits of democratic procedures for themselves but they do not seem to recognize the obligations that go with these rights. In other words, co-operation, which is one of the main ingredients in democratic action, to them, is when the rest of society does what they want, but they do not want to play along if their ideas are not followed. They seem to want special privileges.

At present, for instance, communists are quite willing to co-operate with the other countries who are still allied with them, if these countries are willing to follow Stalin's dictates. So many of us seem to have these Stalinistic ideas — co-operate, fine, but do it my way.

Most teachers are quite agreed that classwork ought to be carried on in a democratic manner. They give their students a voice in many of the problems that arise. They teach them how to co-operate among themselves and with the teacher. They preach the value of co-operation — teamwork — on the athletic field.

But in their own relationships with other teachers, and with the administrative heads of their schools, departments, etc., they do not feel it necessary to practice these same ideas of co-operation to make the work of the school as effective as possible. They seem to have the feeling that their personal desires transcend the needs of the students. They forget that the main purpose of the school is to educate its students, not to give jobs to teachers.

They also forget that the fact that they are not co-operating affects the effectiveness of the school. The students quickly sense the disunion caused by the nonco-operative spirit of the teachers. What effectiveness, therefore, will the lip service of these teachers have when they speak to their classes on co-operation?

Decisions can never be made that will be acceptable by all. In any school system employing more than one person, there will be differences of opinion. When rules are made by the man or men in authority, they must be accepted by all if the greatest efficiency in that school is to be attained. Anything less than that, will only cause the faculty to work at cross purposes.

ANOTHER BIT OF RELATED INFORMATION

Numerous folders are available, describing materials with which students in various parts of our country do not usually come in contact. Much of this information is very interesting and can well be used to enrich the related material that helps our students to obtain a good background for the practical work which they get in our school shops.

Such a folder is the one just released by the Western Pine Association, 510 Yeon Building, Portland 4, Ore., titled "Lodgepole Pine Facts." This Rocky Mountain lumber received its name from the fact that the Indians used the small-sized trees for tepee poles.

It is now manufactured into general purpose lumber and is widely used in the Rocky Mountains and the Pacific Northwest.

Douglas Fir, once classified separately by botanists, is now considered to be the same as lodge-pole pine. Lodge-pole pine saw timber is found in eleven western states east of the Cascades and the California coast range. It also grows in the Black Hills of South Dakota. At present about eighty million board feet of it is manufactured annually in Utah, Colorado, Wyoming, Idaho, Montana, Washington, and Oregon.

Interesting facts like the foregoing can be made into interesting bulletin material, especially when it is accompanied by a few colored or black-and-white illustrations, maps, diagrams, and some finished and unfinished sample pieces.

It will also be found excellent for short three- to five-minute talks for various types of classroom use.

THAT AWFUL NOISE

Wilson P. Green, professor of mechanical engineering at the Illinois Institute of Technology, is making some unique studies at reducing troublesome noises. The test room for his studies consists of a double-walled chamber resting on a 6-in. pad of soft rubber. The space between the double walls is filled with fireproof Fiberglas.

In testing a gasoline engine, for instance, the part that makes the greatest noise is investigated first. After that has been quieted down, another part is selected and worked upon, until all of the noises of the entire engine have been reduced.

The engines worked upon at the Institute of Technology to date, ranged from a 2-lb. 1-h.p. lawn mower to a 200,000-lb. 2,000-h.p. Diesel.

A combination of camera, magnetic recorder, and sound analyzer chart the over-all noise, and the engine is then stripped so each mechanical part, operating separately, can be studied for noise reduction.

Mr. Green maintains that "any engine, automotive, locomotive, or power plant, can be quieter. Proper diagnosis and design can muffle at least 50 per cent of the noise without altering power or efficiency."

The foregoing might be an incentive for some shop teacher to study the noises in the school shop in order to quiet the main noisemakers, mechanical as well as human, to some extent. It is by these painstaking methods that scientists learn how to improve the technological wonders with which we are surrounded and continually improve our modern way of life.

The Value of Research to Industrial-Arts Education

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As civilization becomes more complex, there come men, books, and organizations exercising authority in their particular domain.

Sources of professional scientific knowledge are being made in order to keep pace with the age. Under such changes and notions, it is very evident that we must have available research material for the industrial-arts teacher. The research material thus gathered will prevent his going into blind paths, and will prevent the formation of empirical ideas.

The ultimate purpose of all educational research is the discovery of procedures, rules, and principles relating to the various aspects of education.

Critical reflective thinking is required, in which the discovered facts and principles may be utilized, as well as original data recorded. Thus the answering of any question about education or industrial education by means of critical reflective thinking, based upon the best data obtainable, may properly be called educational research.

Research is not merely a cursory search for truth, but a prolonged, intensive, and purposeful search. It comprises defining and redefining problems; formulating hypotheses or suggested solutions; collecting, organizing, and evaluating data; making deductions and reaching conclusions; and last, carefully testing the conclusions to determine whether they fit the formulated hypotheses.

Methods of Approaching Educational Research

Any education that attempts to formulate deductions based on carefully collected facts without supporting evidence, and which strives to advance the frontier of education is a research education. There are several methods of approaching the problems in educational research.

Kelly, in his book, "Scientific Method," divides research into four classes: (1) the historical method, (2) the experimental method, (3) the method of future estimation, (4) the scientific method.

In the historical method, the historian must write with a motive; in one sense, this is to say, with a bias in his immediate interest. In industrial-arts educational research, it is not the purpose of the researcher to be biased, nor does the researcher want to be limited to one time or age. It should be the aim of every researcher to give everything due consideration, and to allow the results of his efforts to be tested by anyone in the present or in the future. The historical researcher cannot, in view of his bias, seek information with any such lofty motive, therefore, the historical method is seldom applicable to industrial-arts research.

On the other hand, the experimental method requires too long to obtain results that are reasonably accurate and uninfluenced by other conditions. Then, too, because of the limitations, as to time, as to place, and as to other conditions, this method does not yield standard tests, or other standard criteria applicable at all times and under various conditions; therefore, the experimental method finds but limited use in the field of industrial-arts education.

The future estimation method is based upon an estimate of the probable needs in a time yet to come. An estimate at its best is but a guess, so that the correctness of the guess cannot be known until the assumed time has materialized. This method will not meet the needs of the industrial-arts researcher because its value cannot be immediately tested, or the results immediately applied.

From the foregoing discussion we can deduce that results of a method of research, to be applicable to industrial arts, must be: (1) unbiased; (2) obtainable over a reasonably short period; (3) standardized, and applicable at all times and under various conditions; (4) readily tested, and applied in the present.

The scientific method embraces all of these characteristics, with none of the attendant evils of the other methods.

The Scientific Method

The scientific method is a method of solving problems, and the first prerequisite is to have a definite knowledge of what is sought. Since in the solution we get a relative value, the solution must be examined carefully to determine its acceptability. Native intelligence, whatever that may be, probably has a great deal to do with it, as does particular knowledge, special training, and experience. It enables one to be successful in his work, due to his training and experiences.

The industrial-arts teacher is qualified by both experience and training to attack research problems of an educational nature. The principal training is training in the art of scientific thinking.

The rules that govern scientific thinking are:

1. Give first place to facts.
2. Do not multiply theories unnecessarily.
3. Avoid the fallacy of rectification of abstraction.
4. Regard analogy as a source of suggestion, not as a proof.
5. Apply the test of agreement to both positive and negative cases.
6. Scrutinize all statements purporting to be true.
7. Avoid basing conclusions on a few cases.
8. Be consistent and coherent.
9. Use precise terms.

It is evident in the first rule that we must give first place to facts; not to what we think things ought to be; not how it could be; not as others around us think they should be; but as the facts demonstrate that they are. The acceptance of the facts as they are will eliminate the drawing of false conclusions, and interpretations unsupported by the data.

Many years ago Voltaire wrote: "Universal consent is not a proof of truth." That timely philosophy is often obscured under an ever increasing deluge of new and fancy theories. General laws without proof, regardless of the length of their use, are still theories; and if other deductions are based on these theories, which are subsequently proved to be fallacious, then the whole structure is rent asunder with the falling of the basic theory. On the other hand, deductions based upon established

laws are foolproof. It is evident, therefore, that in any research purporting to be of the highest caliber there should be a minimum of theories.

True thought avoids false appearances, deception, and fallacious conclusions, by subscribing to general cases, rather to rare exceptions. While there are exceptions to all rules, principles found to be true in the majority of cases are much more reliable and subject to prediction.

Things are not always as they seem. In every new problem, there are extenuating circumstances which make this new problem just a bit different than the last problem involving like principles, so that we can only regard our previous solution as a guide in our present case. Each new thought should be carefully weighed and criticized with the rule in mind that, analogy is a source of suggestion and not a proof.

Apply the test of agreement to both the negative and the positive sides of all questions and then the missing of any good arguments for or against is avoided.

The foregoing rules have guided researchers in the fields of pure and applied science, so it is suggested by analogy that valuable aid to industrial-arts will come, if researchers follow the same procedure. We observe that scientific knowledge is free from bias, it is exact, it is verifiable, and it is systematized. This last is the goal that we strive to reach in the field of industrial-arts research.

The adoption of such a standard in industrial-arts education research would materially aid in the solution of many of our industrial problems of record of today. The researcher would have at hand all of the necessary data, assembled and passed to him by a previous worker in the field.

In medicine, the physician usually passes his diagnosis of a patient, to another doctor or to a hospital; this enables the new attending doctor or doctors to resume the treatment at the exact place that it was left off. As with medicine, so it should be with industrial-arts research. The handling of industrial-arts research problems in such a manner would certainly be more conducive to thoroughness and an assumption of the scientific attitude.

Industrial-Arts Research Bureaus

In many schools, industrial-arts research bureaus have already been established as a part of the system. In the files of these bureaus are to be found, in some cases, the record of every student in the system; in other less extensive bureaus, the record of each student whose case is any way unusual, as to health, discipline, etc., is found.

These records are not important because they show the relative scholastic standing of the student. These records are important because they show the results of standardized tests which have been administered to the student. The records show, among other things, the intelligence quotient, the percentile standing in other intelligence tests, and in many cases, the test-paper itself. As in general educational research, so in industrial-arts educational research, the materials and the problems are actual existing cases. The histories of these cases are important for other reasons.

By an analysis of these histories we seek to discover if the child is listless in school, lacks interest in his work, or fails repeatedly. The analysis of the histories also seeks to find the reason why these characteristics of delinquency exist. After a proper interpretation of the data, the teacher should attempt to correct these shortcomings by directing the activities of the child, seeking to reinstate the child in his work.

Research arms the present and the future teacher against certain defects, and helps him in his future program by helping him to know the causes of his problems. With this information, the teacher is better prepared to know the direction in which to look for an adequate solution. The research usually reveals to the industrial-arts teacher whether certain problems, as propounded by him, are profitable to the age. It aids in a scientific analysis of society, to discover its needs. The industrial-arts research in education aids the teachers in increasing their knowledge, and their ability to do more efficient work. Research also aids the teacher in improving his methods, by affording a comparison of the methods pursued by others under varying conditions and times; and the teacher profits by the experience and the contacts thus afforded.

The teacher seeks problems and puts forth every effort to solve and aid in their solution. He considers his occupation fascinating because he has human beings to study and work with and not stones, bugs, fossils, or old manuscripts. The subjects being studied are only youths—youths who are different in strength, talent, and character; different in origin, growth, and need. In studying them, his scope is broadened and his capacity to understand is enriched. Not only will his knowledge be increased, and the quality of his subject matter improved, but he will have the skill to make his work more effective.

Industrial-arts education aids in the process of education in that it aids the teacher in making useful changes in his own habits, skills, knowledge and ideals; and he in turn passes them on to the students who in their turn pass them on to the

A final polish is given a model car designed and built by David Van Hart of Elizabeth, N. J. This boy's entry last year won him $50 third place award in the state competition of the Fisher Body Craftsman's Guild

community. From a social viewpoint there will arise better adaptability, and better control of the features of natural and social environment — to this end industrial-arts research will become an asset to any city, county, state, or nation.

Value of Industrial-Arts Education Research

Industrial-arts educational research is valuable in that it turns the spotlight on the past; and we can trace it because of its reflection in the present time. In this important aspect, the growth of a coral provides us with an analogy. Its past is unchangeable and absolutely dead, only its upper surface is living. But that upper surface and our present are built upon the dead past. If this were not so, what interest could a dead past have for us as living and planning individuals? The deadness of time puppets, and the rigidity of their bequeathal fairly imbues us with a sense of verity. Our present industrial-arts course, which is a main spoke in the wheel of educational progress, is founded on the "Sloyd System" (Sweden).

The wonderful spirit and value of industrial-arts educational research is exemplified in the contemporary writings of Dr. W. C. Trow, Prof. T. L. Kelly, Prof. C. C. Crawford, and many others, including P. M. Symonds, Carleton Washburne, Clifford Woody, Walter S. Monroe, George W. Frazier; and in such magazines as: INDUSTRIAL ARTS and VOCATIONAL EDUCATION, and *Journal of Educational Research*.

Controversies are always arising, and in order to keep an orderly process, there must be some law, some standard, or some custom for adjudication and settlement. In the field of industrial-arts education research is the criteria by which all disputes are settled. Besides aiding in the solution of controversial points, research keeps down stagnation.

We know too well how offensive stagnant water is, so it is with old unrevised systems. The research encourages superior teaching, professional growth, and provides a mass of information, both for the teacher and for the community at large. Finally, the research reacts upon the industrial-arts teacher spiritually. The fresh point of view which research engenders, should not be denied the industrial-arts teacher. This fresh point of view gives him the spirit of inquiry, of open-mindedness, alertness, and sureness.

The ultimate value of this research to an industrial-arts teacher, is the discovery of procedure, rules, and principles relating to the various aspects of the industrial-arts field, and it fits him to determine what he should do or should not attempt to do in teaching industrial arts to children or to adults. Research enables the teacher to know what is, and what has been, and provides him with an understanding of true values.

Therefore, a research that gives new life, information, better rules, inspiration, elevates the community, and prevents stagnation, is in every sense a procedure of incalculable benefit.

Selecting Students for Industrial-Arts Teacher Training

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Teachers in industrial arts are shouldering a greater responsibility today than during any time in the history of public education. Some of the factors that have added to the burden of the teacher are: larger classes, the preparation of students for a life that is increasing in complexity, and the mounting cost of education.

There was a time when a teacher who turned out students well trained in shop skills was considered satisfactory. Today, good teaching includes justifying the cost of the education and training given a youth embarking upon his adult, civic, and vocational life.

The requirements of good teaching are rapidly approaching the stage where the person permitted to enter the teaching profession must be the best possible and he should be selected as carefully as reliable techniques will permit. Authorizing a student to take training for four years in preparation for teaching upon the basis of a pleasing personality, failure in some other field with teaching as a last resort, or an interest in shopwork and very little else is a vestige of an era that represents the past and not the highly competitive future.

The industrial-arts teacher of tomorrow must not only want to teach, he must be qualified to teach according to every desirable characteristic required to do the job successfully. He must possess the ability, interest, aptitudes, and personality that his position demands.

There is no substitute for a good teacher. Regardless of administrative efficiency, educational theories, facilities and equipment, the success of the industrial-arts program depends upon the shop teacher personally. The human efficiency of our schools is directly proportional to the degree in which qualified people are selected and trained to perform the task of teaching.

The increasing demand for industrial arts in our schools offers a challenge to teacher training institutions to supply the very best teachers possible — teachers not only competent to teach effectively, but capable of inspiring students to higher ideals and preparing them for successful living.

Psychological Testing

In order to provide teachers of the highest caliber, it would seem that a beginning should be made by selecting desirable candidates for training.

The practice of selecting by testing or determining individual differences is probably as old as mankind itself. It was known to be used by the Greeks who tried to determine and describe different types of people.[1] However, it was not until the latter part of the nineteenth century that scientific procedures were used to make quantitative studies of human behavior.

Sir Francis Galton (1809) was among the first to conduct psychological studies and was particularly interested in mental imagery and visual experiences. In the early part of the twentieth century, Cattell,

[1]All footnotes have been placed at the end of this article.

Binet, Terman, and others conducted studies pertaining to intelligence testing. In 1919, the U. S. Army enlisted the help of psychologists for the purpose of classifying the soldier draft. Intelligence tests were used on a large scale, giving us the famous Army Alpha and Beta group tests. World War II gave a further impetus to psychological testing and selection in the military service and in industry.

Testing and selection has become quite a general practice where it is possible to classify people according to types or occupational skills. In selecting students for training to become doctors, lawyers, engineers, and many specialists in industry, tests have been developed to a rather high degree of reliability.

Judging by the success in the professional and occupational fields, it does not appear to be an insurmountable task to provide a program for selecting by scientific procedures candidates who wish to specialize in teaching industrial-arts subjects.

Criteria of a Good Teacher

An approach to the problem of selection might be made by determining the factors by which a teacher is recognized as successful or unsuccessful. It is not a very profound task to list the characteristics and traits of a good teacher. He has been described by educational writers in glowing terms. All of us have had teachers we rate very highly. Then, too, many essayists have described the qualities they consider most desirable based upon personal appeal. While such discussions are interesting, they offer little of scientific value.

In a more realistic analysis of teacher qualifications, Hippaka[2] mentioned the following characteristics to be essential attributes of a good industrial education teacher: personality, teacher-pupil relationships, knowledge and technical skill in the subject field, teaching methods and devices, guidance and mental health mindedness, shop management, effective cooperation with administrators, supervisors and other teachers, pupil management and control, workmanlike use of equipment, teacher-parent relationships, and appropriate use of supplies.

Ammons[3] points out the traits of the successful industrial-arts teacher to be as follows:

1. Desirable physical qualities
2. A high degree of general intelligence
3. Moral qualities: honesty, integrity, dependability, and sincerity
4. Social qualities as indicated by courtesy, helpfulness, and thoughtfulness
5. Aesthetic qualities, with a high appreciation for art
6. Training and professional preparation

Regarding teaching ability, Barr[4] found that intelligence was the highest single factor conditioning teaching ability and remained so even when in combination with other teacher measures. Also he reported that the attitude of teachers toward teaching is significantly correlated with teaching ability.

Eliassen and Martin,[5] who advocated choosing prospective teachers by a more selective process, said that success in teaching depended largely upon personal qualities and that while no single factor predicted teaching success, intelligence test scores with subject marks had the highest prophetic value.

Additional evidence of the characteristics most desired might be found by the examination of teacher rating scales used by administrators and supervisors. In a very extensive study conducted by Kissinger,[6] the most desirable personal qualifications were given as follows: physical attributes, initiative and leadership, effort, enthusiasm and optimism, co-operation, and objective results, such as progress and behavior of students.

Predicting Scholastic Success

In approving students for teacher training, it is essential to select those who will be scholastically successful as well as deeply interested in the training they will be required to take. There is some evidence to indicate that scholastic success may be predicted. In a study of over 1000 high school students, King[7] found that interest tests were of value for indicating the field of secondary education in which the student would probably have his best success. Froehlich[8] reported that the best predictive index for success at the university was rank in the secondary school graduating class. Douglass[9] showed that when two or more years of college work are prerequisite, the average of the grades made is valid for predicting future scholastic success.

Selecting Potential Teachers

There is very little conclusive evidence that any one factor or group of factors predict teaching success reliably enough to be adopted in general by departments of industrial-arts education to serve as a basis for selecting students. The job of teaching involves many complex relationships and represents a constellation of factors which are not readily measured by a few specific traits or characteristics.

From the evidence presented, and as a working basis, one may assume the characteristics of a teacher to be as follows:

1. He should have a personality that encourages good relations with others.
2. He should have broad interests and varied experience indicative of living a full life.
3. He should personify good citizenship and be concerned actively in the problems of our country and community.
4. He should see education as a means to enable youth to achieve not selfish interests but those interests that will contribute the greatest good to the largest number.
5. He should have specialized knowledge and skill and be able to adapt it to the needs of his students.

Certain measurable factors may be considered in selecting students for industrial-arts teacher training. These are: (1) intelligence, (2) interest, (3) personality,

Drafting room, submitted by Benjamin Novak, Dobbins Vocational-Technical School, Philadelphia, Pa. See article on page 182

(4) mechanical aptitude, (5) mechanical comprehension, (6) spacial relations, (7) reading ability, (8) achievement tests in various school subjects, and (9) rank in high school class or in lower division of college.

In addition to determining the measurable factors, it would seem that further investigation through a personal interview would increase the probability of selecting the most desirable candidates. Factors that should be considered when conducting the interview are as follows:

1. Attitude toward people and life
2. Attitude toward teaching
3. Work experience
4. Hobbies and leisure time activities
5. Home background
6. Degree of social adjustment
7. Freedom from emotional defects
8. Leadership ability

The proper selection of students for training in the field of industrial-arts education will not only improve the quality of teachers and teaching, but it will be a means of enabling prospective students to determine their probability of succeeding in a profession that is constantly requiring people of higher qualifications.

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A Brief Training Course for Conference Leaders

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(Continued from page 397 of the December, 1949, issue)

SESSION IV

Drawing Conclusions

I. What are the possible conclusions? List them.
II. Testing the conclusions.
  a) Against the facts
  b) Against the possible effects on
    1) Individuals
    2) Groups
    3) Management
    4) Production
    5) The public, etc.
III. Selecting the best conclusion.
IV. Trying it out.
  Make a definite tryout in a limited situation.
V. Practice session on organizing facts. 10 minutes each

Drawing Conclusions

The scientific method involves the following steps:

1. There is a *felt difficulty*. In other words a problem is sensed only vaguely.

2. *Definition of the problem*. This involves a study of the difficulty and a statement of the problem in broad terms. This is then limited in scope for an investigation.

3. *Gathering data* or collecting facts. Here the scientist draws first upon personal experience, then upon the experience of others given orally or in writing, and finally upon research or experimentation.

4. *Organization of data or facts*. Here, facts are organized for study. This is often called classification of facts.

5. *Making an hypothesis or guess*. A guess as to the possible solution is made. Often several such guesses are made.

6. *Testing the hypothesis or guess*. This is a planned tryout to see whether or not the guessed solution will work under all circumstances. Each possible solution is tried out in this manner until the most satisfactory one is found.

7. *Drawing conclusions*. After the guesses or possible solutions are tested, a conclusion is reached, and written. This conclusion often may be made the basis for solution of another problem.

8. *Application of the conclusion*. Here it is determined where, when, and under what conditions this conclusion or principle can be applied.

The steps followed in problem solving of the type encountered here are very similar to those used by the scientist, namely,

a) Stating or defining the problem.
b) Getting the facts.
c) Organizing the facts.
d) Drawing conclusions.
e) Making applications.

There is this difference to be noted between the scientific method and its application in conference thinking. Where the scientist may actually try out and test his possible conclusions or guesses, conference groups test them by drawing upon the experience of the group. The testing is largely a mental process. Improbable conclusions are discarded quickly by the general reaction of the group. In this manner many possible or probable solutions or conclusions are checked very quickly. Those possible conclusions which remain may be put to an actual tryout test before final conclusions are drawn.

Thus conclusions or suggested conclusions are checked:

1. Against experience of individuals.
2. Against experience of group.
3. Against experiences of management.
4. Against experiences of specialists, etc.

The best possible conclusion is selected for application. A definite tryout on a production basis should be made. It should be under normal rather than experimental conditions. The effect should be watched very carefully for a period of time to make sure that there are no other modifications needed to make it work.

In session III, for instance, the conclu-

sion was reached that on the basis of facts at hand, women should be capable of becoming good supervisors.

The next step is to try them out in certain departments which offer an opportunity for unprejudiced trial. It should be borne in mind that prejudice against women as supervisors is a fact. Since it is a fact, the success of women as supervisors would tend to be limited unless a definite campaign is launched to overcome this prejudice.

In summary, it might be said that conclusions drawn from facts which have been tested and organized, should be sound and worthy of application. Such a procedure should save time, trouble, and effort in the long run. It is the application of a plan or a system to eliminate errors in judgment.

SESSION V

Making Applications

Making proper and adequate application of the results of conference thinking is the final test of its worth. The purposes back of group thinking in business and industry are largely confined to the practical rather than the theoretical. Such groups are not interested in the development of a body of theory but rather in the practical application of the theory. If it works, well and good, but if it does not work it is readily discarded. Interest in group thinking can be readily killed by failure to make applications of the conclusions that have been reached in their deliberations.

Our Problem

Our problem, therefore, is to see to it that applications of the conclusions are made and that quickly enough to keep interest alive. To do this the following questions should be applied.

1. Why will it apply?
2. When will it apply?
3. Where will it apply?
4. How will it apply?
5. By whom should it be applied?

It might be well to apply these five questions to the problem used as an illustration in this connection. It was concluded that — women should be capable of becoming good supervisors.

Why will it apply?

This question becomes a check on the group thinking. What facts will support this question? An analysis will show that the following facts, which were brought out in the conference, tend to answer this one question. It will apply because:

a) Women are available.

b) Women have proved their ability to supervise in business, offices, and schools.

c) Women have proved their ability to learn mechanics.

d) Women do understand human nature as well as men.

e) Women have demonstrated their ability to teach.

When will it apply?

This question might be answered in several ways. It may apply now in some cases. It may apply when men workers or supervisors become scarce again, as was the case during the last war.

Where will it apply?

This question will always help to clarify a situation. Obviously there are certain places in which applications may be made more readily than others. There are places in which the need is greater or the prejudice less; where the work is more detailed or lighter; where there are more women workers now employed; or where factory conditions are more desirable for women workers.

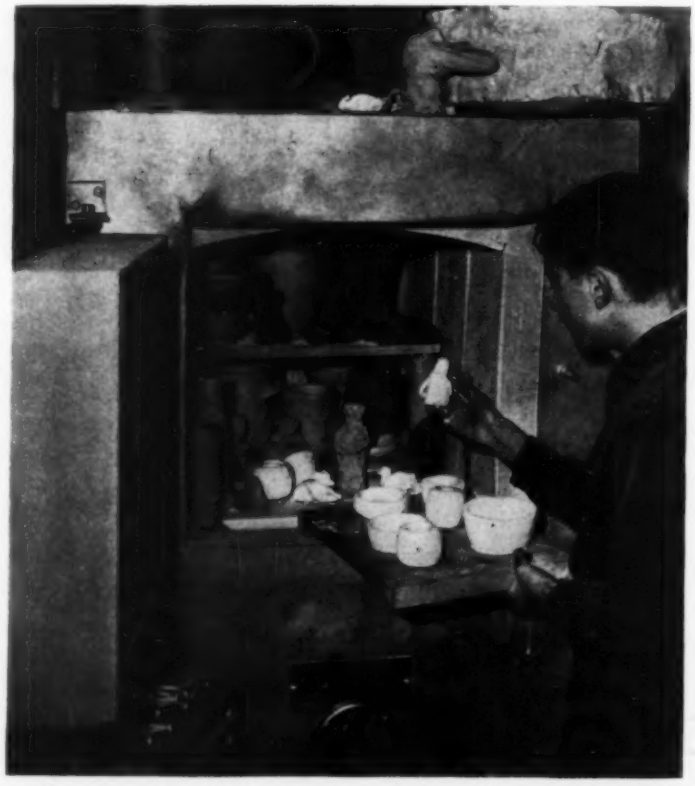
How will it apply?

"How" may be a combination of the when and where. It may be dependent upon certain changes. It may depend upon a planned program of introduction with an experimental tryout in various departments under varying conditions.

By whom should it be applied?

In this instance the application should be made by one who is fair-minded, unprejudiced, and a good observer. It might be one entire department or only a segment. It should be remembered that all new ventures are going to meet with some opposition. It is unfair to any new venture to make its application in a situation where preconceived opinions are against it, where leaders or workers are not in sympathy with the move or are unwilling to experiment willingly and fairly. Therefore, *extreme care must be taken in the selection of persons or departments in which applications are to be made.*

Determine variations in the application. It is obvious that certain variations in the application of conclusions are inevitable. A plan that will fit one situation will not fit another equally well without some modifications. All situations differ, therefore applications must differ. For instance the requirements regarding a certain type of headdress for women is imperative in one department but not so much so in another which is very similar. Even though the requirement or rule is necessary in many situations there will be some minor changes or variations which can be made to good advantage. Rules governing smoking are required in most departments but they do



The work of a pottery class at the Barclay Secondary School, Stevenage, goes into the kiln for baking. Photograph supplied by the British Information Services, New York, N. Y.

not all have to be identical. The success of any plan, rule, or principle is largely dependent upon its flexibility or adaptation. Therefore, *be sure that all possible variations in application are studied before general application is made.*

The remainder of this period should be given over to supervised practice in conference leading. All four phases of conference leading should be included in these practices.

Conclusion

In conclusion let us bear in mind that good conference leading demands;

I. Setting the stage.
II. Getting facts from the group.
III. Organizing facts presented.
IV. Drawing conclusions and testing them against the experience of the group.
V. Making applications of the conclusions. In this process one should raise the questions — (1) Why will it apply? (2) When will it apply? (3) Where will it apply? (4) How will it apply? (5) By whom should it be applied?

Although conference leading may be an art it is something that most individuals can learn. Each one might fail to be an artist in some phases yet all will become better conference leaders by consistent practice.

Consolidated School Shop Plan

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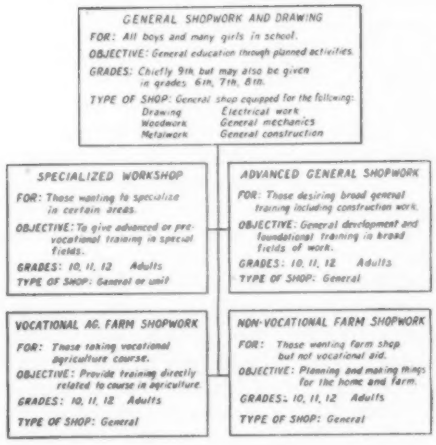
The accompanying shop plan shows a practical set-up for a consolidated school where the aim is to offer a comprehensive program of industrial arts and farm-shop work in an efficient manner to serve *all* of the pupils of the school.

Such a program is indicated graphically on the accompanying chart. It will be seen that the plan provides for general shopwork and drawing for beginners; advanced general shopwork for those desiring such experiences; specialized shopwork for advanced pupils; farm shopwork for those not following the vocational program in agriculture; and the typical farm shop directly related to vocational agriculture.

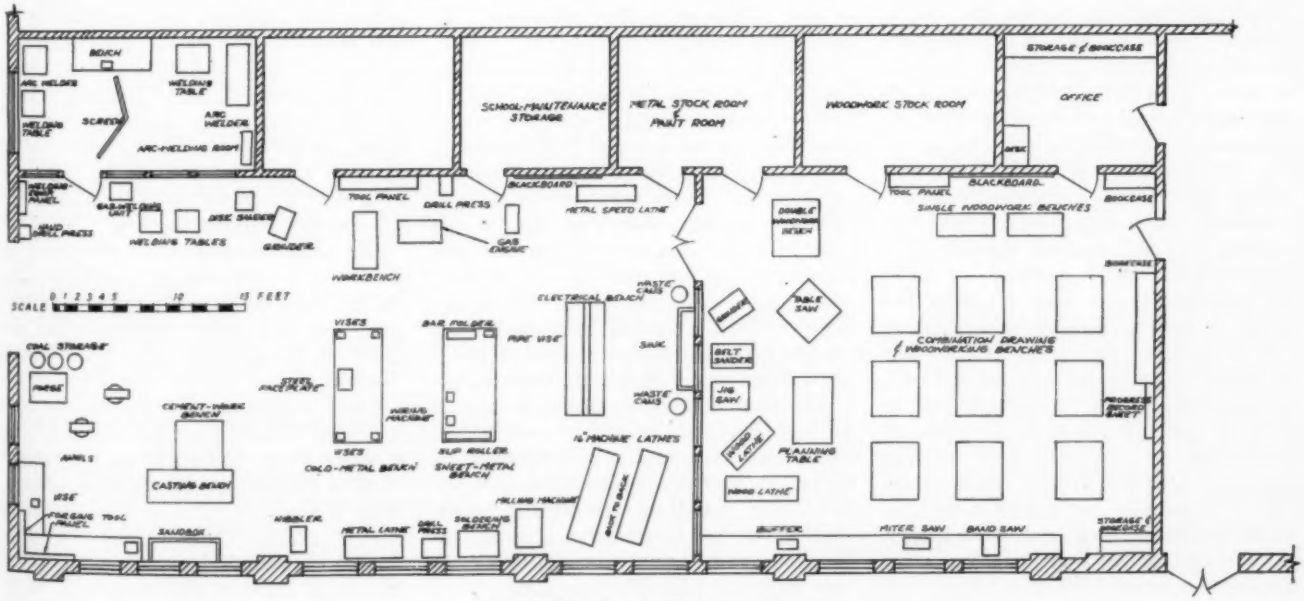

GENERAL SHOPWORK AND DRAWING
FOR: All boys and many girls in school.
OBJECTIVE: General education through planned activities.
GRADES: Chiefly 9th but may also be given in grades 6th, 7th, 8th.
TYPE OF SHOP: General shop equipped for the following:
Drawing
Woodwork
Metalwork
Electrical work
General mechanics
General construction
SPECIALIZED WORKSHOP
FOR: Those wanting to specialize in certain areas.
OBJECTIVE: To give advanced or pre-vocational training in special fields.
GRADES: 10, 11, 12 Adults
TYPE OF SHOP: General or unit
ADVANCED GENERAL SHOPWORK
FOR: Those desiring broad general training including construction work.
OBJECTIVE: General development and foundational training in broad fields of work.
GRADES: 10, 11, 12 Adults
TYPE OF SHOP: General
VOCATIONAL AG. FARM SHOPWORK
FOR: Those taking vocational agriculture course.
OBJECTIVE: Provide training directly related to course in agriculture.
GRADES: 10, 11, 12 Adults
TYPE OF SHOP: General
NON-VOCATIONAL FARM SHOPWORK
FOR: Those wanting farm shop but not vocational aid.
OBJECTIVE: Planning and making things for the home and farm.
GRADES: 10, 11, 12 Adults
TYPE OF SHOP: General

Phases of shopwork and drawing in rural areas

It will be noted that the shop consists, essentially, of two parts separated to some extent by a glassed partition but with wide double doors so that the parts can be used individually, perhaps by different teachers, or as a whole by one teacher. The part of the shop at the right of the partition provides for drawing, planning, and more elementary types of industrial arts while the part at the left provides for advanced types of shopwork and for farm shopwork.

Another feature of the plan will be noted in the ample storage space provided to take care of materials and uncompleted projects.

This plan has been provided and carried



Consolidated school shop plan

out with the idea that pupils in rural areas, regardless of their future occupations, should have opportunities in broad fields of industrial arts similar to those provided in urban areas because many of them will not be farmers and those eventually taking farm shopwork as a part of vocational agriculture should have a broad experience before their specialization.

Some of the equipment indicated was obtained as war surplus and is of heavier type than absolutely necessary and hence may be replaced by lower-priced equipment if necessary.

Your Course Has a Personality

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This article is an introduction to a series of anecdotes, prepared to serve as background material for instructors or students of electricity.

The original was a colloquium paper submitted as a part of the author's graduate work in the industrial education department at the University of Minnesota.

These anecdotes may also be used to fill in moments when the entire class is waiting before changing classes, or when similar moments, that would otherwise be spent in idleness, arise.

The Personality of the Course

Shop men pride themselves on being a group of regular fellows. They hold get-togethers and organize clubs and associations to further comradeship and fraternization. The majority are well liked by their associates and the students in their classes. This wonderful indication of general personality speaks highly of the profession.

Personality is so important in really good teaching that this attribute should not be neglected wherever it is found. It makes the instructional job more enjoyable and the result more meaningful to the student.

The well-liked teacher is able to adapt himself to the situation at hand, and he is an interesting person in possession of interesting information. It is here, in the informative or academic part of shop courses that the "personality" of the course itself is formed. It, too, should be adapted to the situation at hand, and be interesting.

All shop courses contain information. Technical information is that which is essential to the job or operation. It must follow the narrowly plotted path of the operation it supplements. This phase of shop courses becomes rather stereotyped.

We may compare technical information with the physical being of a person. It is like the arms, legs, eyes, ears, and other essentials which make it possible for the body to function. Usually, however, we are not attracted to a person by only the physical. It is the more intangible "personality" which makes us enjoy the company of one person and dislike that of another.

The personality of our courses is determined by the general information offered — the nice-to-know, cultural material. General information can be varied to add color and interest to each individual course. It can give each course a personality of its own. This personality must not be always gay and frivolous, nor must it be gloomy and dull. Like the personality of a person, a balance of the serious and the pleasant is preferred.

Carefully selected general information forms the well-rounded personality desired, and also makes the subject more interesting and broadens the scope and usefulness of the course. Such things as history, tradition, culture, and tolerances may be taught briefly in the shop when they relate to the topic at hand. Separate units for this material are justified, but should be used sparingly so that manual activity is not slighted. It is suggested that the greater part of such information be used to punctuate other course work more forcefully.

This instruction must uphold educational philosophies and objectives — objectives which concern themselves with development of character, social adjustments, and appreciations as well as with skills and technical knowledge. Presentation of general information helps create the wider concepts and attitudes desired in education.

That these adjustments and appreciations are especially valuable today is evident when we consider that our student, when later employed in an average productive industry, will control power equal to the muscle power of 70 men! Concentrating this much power in the hands of one individual places considerable responsibility upon that individual. In fact, whether or not our student takes a place in industry, his attitudes will indirectly govern the use of our nation's industrial might! It is therefore essential that he realize his position in our industrialized society.

Technical information does not create this realization. Neither does development of manual skills. Only selected general information can adequately correlate knowledge of industry with the social implications thereof. The serious side of the course personality is thus formed.

The lighter vein develops through exploitation of natural interests of the group. Putting prevalent interests of youth to constructive use can provide motivation, contribute valuable content to the curriculum, and make the instructional job easier. It is advocated that use of human interest material, including humor, will give the course that needed colorful spark that breeds enthusiasm.

For illustrative purposes, consider an electricity course in junior high school. At this school level, the students have an intense interest in blood and thunder stories, and all forms of hero worship. A brief study of electricity in crime prevention and prosecution may be indicated. Similarities may be shown between electrical fundamentals used to make police equipment function and the fundamentals studied in the shop course.

Mention of electrocution, morbid as it may seem, is certainly forceful motivation to encourage law abiding citizenship, or to stimulate study of safety to prevent accidental electrocution in school or home. It might at the same time suggest to some students a further study of the effects of controlled electricity on the human body when used as medical therapy.

General information may also serve as the basis for introducing topics for individual digression in studying job possibilities. (Job exploratory experiences are certainly a function of the industrial-arts course.)

Short mention of the electric eel, with its 240-cell battery and its ability to give a severe shock may stimulate one student to delve deeper into the career of zoology, while it may suggest to another a study of electrochemistry. Curiosity kindled by mention of the electrical stethoscope, artificial larynx, or electron microscope may be instrumental in producing another doctor or

research worker. When another student hears that the ignition of an eight cylinder car supplies 12,000 sparks every mile, he may, with adequate encouragement, become the town's best mechanic. The boy who searches out details about the Underwriters' Laboratory and its services may some day buy intelligently enough to save the life of his wife or child.

Then there is the story about the farmer who sprayed his crop with an inflammable chemical. The wind blew the spray on his clothes. When he walked home, his clothes dried, and static electricity generated by the fabric rubbing between his legs set fire to his pants!

One student might apply this lesson to the dry-cleaning business, while another might become interested in chemical methods of producing and extinguishing fire.

Thus having introduced the student to enticing and appealing facts about electricity, it is felt that he may desire further information in a few specific areas of his own interest. This, in turn, may be the avenue for creating desirable impressions and stimulating greater student participation in class activity.

The above illustrations will not be considered technical information. Yet, without background material the person is uninformed. He lacks insight to the implications and relationships that exist between the shop course and the world about him. Establishing this insight is justification for broader information units. This insight is as necessary for the mature vocational student as for the exploratory juvenile, although the technique for creating it may vary from group to group.

General information does not appear as a definite part of an analysis for the shop area being taught. It is of a less tangible nature than the specific operations and technical information required to perform shop duties.

The general information to be presented remains, primarily, a matter of instructor opinion. The items will vary with changing times as new implications of the subject come to light. The items will vary to match the personality of each instructor, and the individual and collective personalities of the class members.

It is by the use of general information that a course itself is given a personality.

General Information for Elementary Electricity

A teacher can, unwittingly, lose sight of the fundamental reasons for his instruction, and bog down in the details of the moment. Projects, shop activities, and information assignments are vehicles for transporting the student to a desired goal. They are means to an end, not the desired result in themselves.

In junior high school particularly, the broader the course and the richer the background material, the more meaningful becomes the course.

Teachers are busy people, and time limitation often prohibits the compilation of background material with which to enhance course work.

The research necessary to obtain this information is usually omitted because more pressing duties such as shop maintenance, material and supply procurement, and extracurricular activity supervision receive precedence.

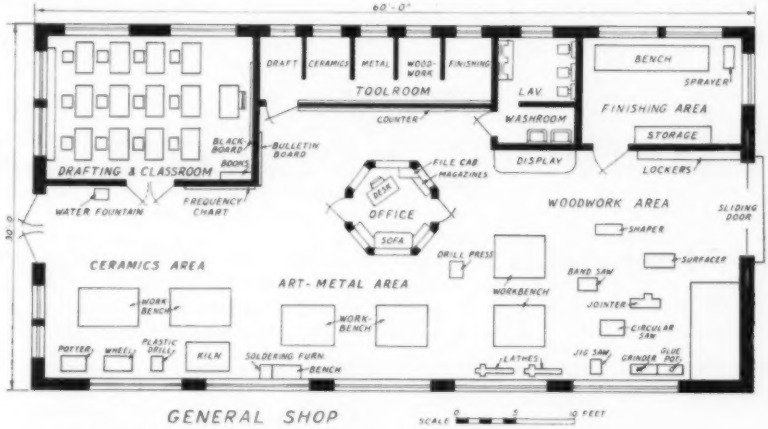
It is hoped that this series of anecdotes will inspire the instructor to use more enriching general information in his electricity courses.

The anecdotes should be selected for simultaneous presentation with the technical information which it supports.

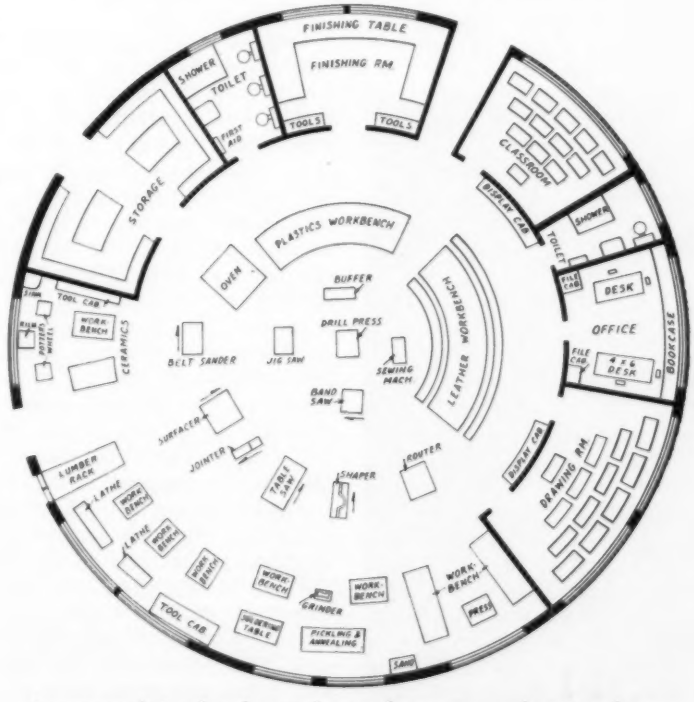
Anecdote No. 1. Static Electricity

Dead Beats For 3000 Years

Man did not accomplish much the first few thousand years he was on earth, electrically speaking. Even you can do the experiment that represents the only addition man made to electrical knowledge in over 3000 years.



Layout produced by students of the shop planning course, Tuskegee Institute, Ala. Withro McEnge, instructor



A proposed circular shop to be used as a comprehensive shop. Submitted by Withro McEnge

Many years ago, man did not know there was such a thing as electricity, but he had experienced it in four ways.

From the days of the caveman to those of the aristocrat of three centuries ago, man was terrified by lightning. He was amused by a hard plastic-like substance that, when rubbed, would attract feathers, corn husks, or bits of dust. He had a touching acquaintance with the electric fish which conduct themselves in a painfully shocking manner. He had seen St. Elmo's Fire, that weird glow sometimes visible on metal tips high in the air.

Of these four experiences, man can be given credit for discovering only one!

The man who saved the day, or rather the several thousand years, was called Thales. He lived nearly three thousand years ago in Greece. Thales, like our American Benjamin Franklin centuries later, was a statesman as well as a scientist. He combined his two abilities successfully when he predicted the eclipse of the sun of May 28, 585 B.C. The eclipse, which occurred during a big battle, so frightened the soldiers that they stopped fighting. Nature, understood by a scientist, brought peace to Greece.

In the role of scientist, Thales took a piece of golden brown pitch, called *amber*, from the pine trees that grew in those times. He noticed that if this amber was rubbed with a cloth it would attract bits of wood and feathers.

Thales was known as one of the seven wise men of Greece, but wise as he was, he was not able to explain why this attraction should exist. He thought the amber had a soul!

You can perform the same experiment with a piece of sealing wax or hard rubber and a piece of wool cloth. Or more simply yet, just comb your hair when it is dry, and watch how the comb lifts up bits of your hair, or little pieces of paper.

The cause? Static electricity!

For additional reading:

H. W. Tenny, *Amber and Amperes* (Pittsburgh, Pa., Westinghouse Electric and Manufacturing Co., 1943), Box 868, Pittsburgh 30, Pa.

Harry R. Gail and others, *A Teachers Guide for Electronics at Work (Transcription Kit)* (Pittsburgh, Pa., School Service, Westinghouse Electric Corporation, 1947), p. 8, Box 868, Pittsburgh 30, Pa.

Advertising Vocational Education

FREDERICK HALSALL
Co-ordinator
High School
Latrobe, Pa.

When the Greater Latrobe Association, an organization composed of business, industrial, and civic leaders, held an "Industrial Exhibition Week," they invited not only the many diversified industries of the area to exhibit their products, but also asked the vocational department of the high school to do the same. All of the exhibits were to be placed on display in the store windows of the business section.

Fig. 1. Latrobe High School shop exhibit

A meeting of all shop teachers was, therefore, called for the purpose of discussing and deciding just what form our exhibition would take, inasmuch as we felt that our window should be comparable to any of the others.

Two small adjacent windows were decided upon, the one to show the contribution that the vocational shops were making to the industrial life of the community, and the other, to portray the life of our school shops. In the first were placed machined parts, patterns, wound armatures, coils, detail drawings, and tracings, as shown in Figure 1. The background consisted of a silhouette of Latrobe industries, together with a descriptive paragraph about our school shop. Figure 2 shows the finished projects, drawings, and textbooks. The background consisted of a pictorial mural of the various shop activities mounted on wallboard. The gear motif used was enlarged from the one usually appearing on the cover of the "Vocational Instructors School Shop Handbook."

Planning the layouts, lettering, and mounting the pictures became the job of the drafting department. The woodworking department cut out and painted the letters, framed the wallboard, and contributed projects. The machine and the electric shop also added samples of their work to the collection. The gears were 30 in. in diameter, and the panels were 2 by 6 ft.

Fig. 2. Projects made in the Latrobe High School shops

In all the schools, during exhibition week, home-room programs were devoted to discussing the histories of each industry and the products as seen in the displays. An assembly was presented in the high school by the industrial department, illustrating the value of trade training. The local newspaper also ran a series of articles concerning each of the windows.

Many favorable comments were heard concerning the exhibit. It favorably illustrated the activities of our school shops, in conjunction with those of industry.

Problems and Projects

PANTOGRAPH

OSCAR H. LEE
Walla Walla College
College Place, Wash.

A pantograph may be used to enlarge a small picture or design quickly and accurately. To make such an instrument is not difficult if a few facts are known. Instructors and students alike will find the pantograph quite valuable.

In order to arrive at the desired proportion of enlargement with a pantograph, the following formula may be used. $K : R = X : Y$. K is the picture that is to be enlarged or reduced. R is the desired reproduction; X, the arm distance from the fixed pivot to the adjustable pivot; Y, the distance between the movable pivot and the recording pencil. The adjustable pivot acts as a fulcrum between the fixed end of the arm and the pencil. Naturally as the fulcrum is placed nearer the fixed pivot the greater will be the range of the pencil. Therefore, the adjustable pivot holes must be graduated, being closer together near the fixed pivot and lengthened in the direction of the pencil.

In the construction of the pantograph an important point is to be able to adjust the instrument to several different rectangles and still maintain a perfect parallelogram. To accomplish this a series of holes is drilled along the length of the arms. The accompanying schedule has been worked out by the author. It will give a minimum enlargement of 1 to 1.1 and a maximum enlargement of 1 to 10.5. The smallest picture which may be enlarged to the maximum (10.5) is 1½ inches in diameter.

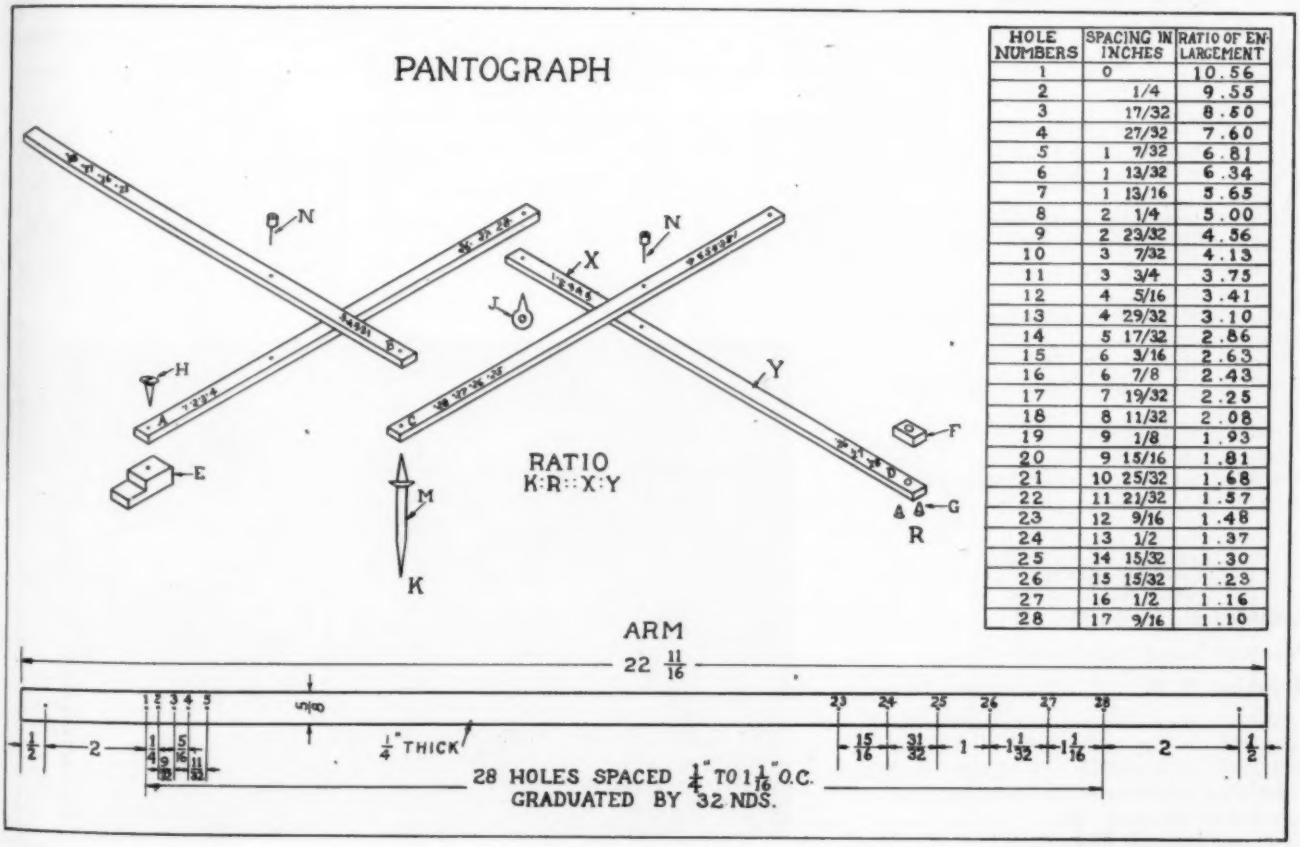
A second important point is to drill all holes from only one layout. That is, lay out the series of holes on one arm only. Then clamp all four arms together and drill the holes.

A third point to remember is to assemble the arms so that the small graduations of *A* are next to the clamp-block. The small graduations of *D* are joined to the large graduations of *A* to form the gliding joint. The small graduations of *B* are joined to the large graduations of *C* with the tracing point. Arm *B* crosses *A* and *C* crosses *D*.

The graduations should be numbered on each arm to facilitate easy and quick adjustment. One method of numbering is to assemble or lay the parts together in the position in which they are to be used. Then beginning with arm *A* at the small graduations number 1, 2, 3, etc., placing all numerals so that they may be read from the tracing point of the instrument. Be careful to start numbering at the small graduations on each arm.

The gliding point may be the small eye screw, *J*. The tracer *K* may be made from a cuphook or a small screwhook straightened out and pointed. The adjustable pivot pins can be made of short pieces of 3/8-in. dowel, and 8*d* finish nails. The lead weight on the pencil end of arm *D* is suggested so that the pencil line will be heavy. An *H* or *F* pencil is recommended.

To operate the pantograph the clamp block is clamped to the table top with a small *C* clamp. Now, for example, say that an individual wishes to enlarge a picture to twice its original size. Select the nearest proportional ratio in the column headed *ratio of enlargement*. Since in this schedule there is no proportion exactly equal to 2, the



HOLE NUMBERS	SPACING IN INCHES	RATIO OF ENLARGEMENT
1	0	10.56
2	1/4	9.55
3	17/32	8.50
4	27/32	7.60
5	1 7/32	6.81
6	1 13/32	6.34
7	1 13/16	5.65
8	2 1/4	5.00
9	2 23/32	4.56
10	3 7/32	4.13
11	3 3/4	3.75
12	4 5/16	3.41
13	4 29/32	3.10
14	5 17/32	2.86
15	6 3/16	2.63
16	6 7/8	2.43
17	7 19/32	2.25
18	8 11/32	2.08
19	9 1/8	1.93
20	9 15/16	1.81
21	10 25/32	1.68
22	11 21/32	1.57
23	12 9/16	1.48
24	13 1/2	1.37
25	14 15/32	1.30
26	15 15/32	1.23
27	16 1/2	1.16
28	17 9/16	1.10

The pantograph

closest ratio, 2.08, is chosen. Now in the column headed *hole numbers* and on line with the 2.08 the number 18 is noted. The movable pins *M, N,* are placed in hole No. 18 on arms *A* and *B;* also in hole No. 18 on arms *C* and *D*. This adjusts the instrument to the approximate proportion of 1 : 2. For every inch which the tracer moves in any direction the pencil will move twice as far in exactly the same direction. The picture to be enlarged is now placed in position under the tracer and a larger sheet of paper fastened under the pencil arm.

The pantograph may be used to reduce drawings as well as to enlarge them. This may be done by exchanging the position of the pencil with the tracer.

BILL OF MATERIALS

	No. of pcs.	*Name*	*Size*
	4	Arms	¼ x ⅝ x 22 11/16
E	1	Clamp pivot block	¾ x 1 x 2½
F	1	Lead weight	⅝ x ⅝ x ¾
G	2	F.h. screws	No. 2 x ½
H	1	F.h. screws	No. 6 x ⅝
J	1	Small screw eye	No. 14 gauge, as glider
M	1	Screwhook for tracer	½ in.
N	2	Adjustable pivot pins	
	1	Small C clamp	

Method of Procedure

Use a good straight grained wood or aluminum.

Cut stock to size.

Rough sand.

Lay off center line on one arm.

Lay off pivot centers as per drawing.

Clamp the 4 arms together indexed arm on top.

Drill all holes with 1/16-in. drill.

Cut out clamp pivot block.

Drill anchor hole for screw.

Cut out lead weight.

Clamp lead weight to arm *D* and drill in corners for screws.

Fasten weight to arm *D*.

Drill ¼-in. hole through arm *D* and weight for pencil.

Finish sand all parts.

Letter each arm.

Number proportional pivot holes.

Finish with shellac or lacquer.

TOY DRUM

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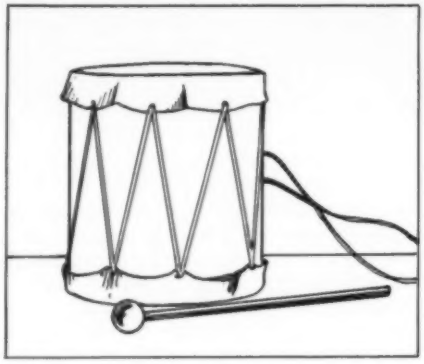
The toy drum pictured here can be constructed in a very short period of time and will make an interesting gift to some small child. This project is constructed from a tin can and an old inner tube.

Tools and Materials Necessary:

1. A number ten tin can.



Toy drum

2. Old discarded rubber inner tube.
3. Five feet of pyro lace.
4. A piece of ½-in. dowel, 10 in. long.
5. Wooden bead 1 in. in diameter.
6. Can opener, hand drill, No. 12 twist drill, brace, No. 8 auger bit, compass, pair of shears, and a paper punch.

Procedure:

1. Remove both ends of the tin can with a can opener.
2. Drill two holes on opposite sides of the can. The holes provide an outlet and intake for air.
3. Paint the can a bright color.
4. Cut the inner tube through the center.
5. With a compass, lay out a circle 8 in. in diameter.
6. Cut out the circle.
7. Punch six holes equidistant from each other and about ¾ in. from the edge of the rubber.
8. Connect top and bottom pieces of rubber with pyro lacing and lace as per picture.
9. To get good results, tighten lace and stretch the rubber.
10. Bore a ½-in. hole into the wooden bead, halfway through.
11. Glue dowel into bead.
12. Paint appropriate color.
13. Transfer a few decals to metal of drum.
14. If, at the end of a few months the drum needs a tuning, simply tighten the pyro lace.
15. Attach a piece of pyro lace to the drum, and make a shoulder loop.

NOVELTY WHEELBARROW MADE OF PLASTICS

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Decorative novelties can be treasured ornaments for whatnot shelves, end tables, and fireplace mantles. Most of the novelties make use of small pieces of scrap materials of Plexiglas or Lucite, but when effectively fabricated and colored, they will compare favorably with other objects of art.

An attractive bit of clever ornamentation may be produced by using small bits of salvaged materials to make the wheelbarrow flower holder, shown in Figures 1 and 2. With careful twisting and forming, a presentable novelty may be made.

A drawing for the flower holder is not included. It simply consists of two pieces of ¼-in. plastic, cemented together and cut into a round disk. The desired number of holes for holding the flowers are then drilled into the disk. The wheelbarrow is built level so that it will hold water to keep the flowers fresh.

BILL OF MATERIAL

No. of pcs.	*Name*	*Material*	*Size*
1	Body	Plastic	1/8 x 1 x 7
1	Bottom	Plastic	1/8 x 2 1/16 x 2 1/16
1	End	Plastic	1/8 x 1 x 1¾
1	Wheel	Plastic	¼ x 1½ dia.
2	Handles	Plastic	1/8 x ¼ x 7¼
1	Rest	Plastic	1/8 x ¼ x 4
		Plastic cement	
		Plastic dye	

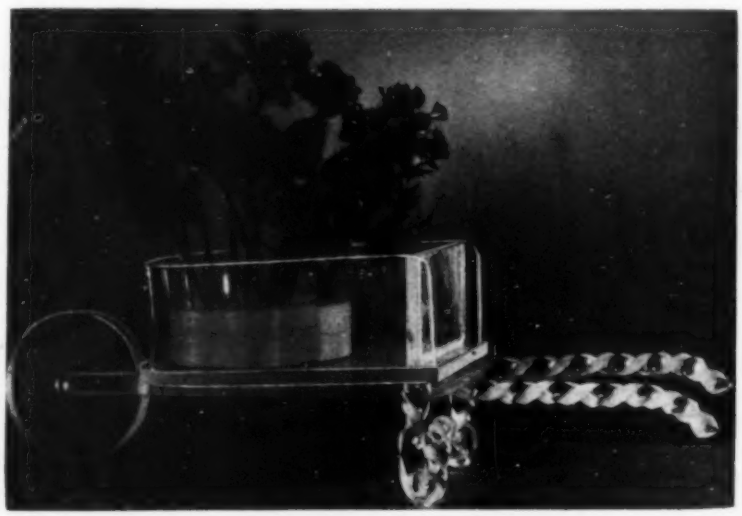

Fig. 1. The finished novelty wheelbarrow

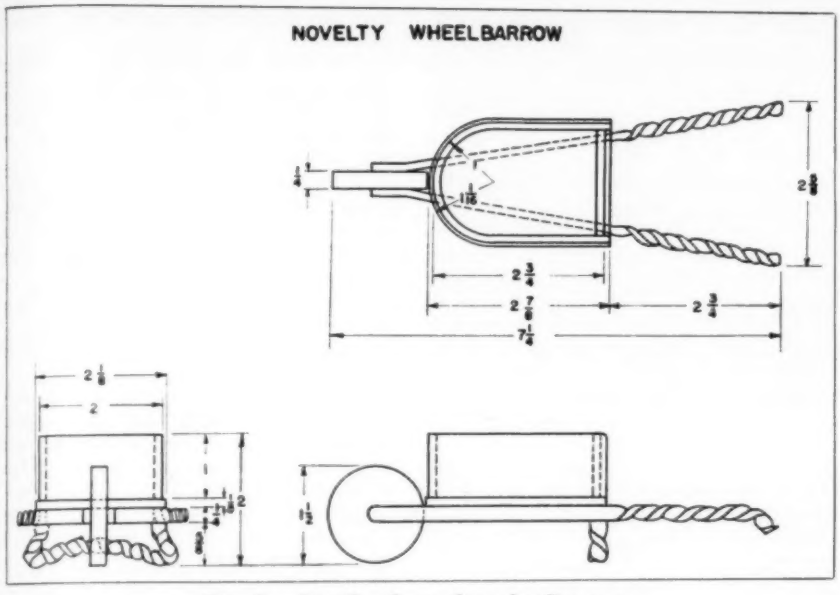

Fig. 2. Details of novelty wheelbarrow

Procedure

1. Lay out all parts on plastic.
2. Cut out pieces with jig or band saw.
3. File the edges.
4. Sand the edges.
5. Buff the edges if desired.
6. Heat and bend the body piece on a wooden form.
7. Heat, twist, and bend the handles as shown in the drawing.
8. Heat, twist, and bend the body rest.
9. Assemble the body pieces and cement them together.
10. Assemble handles and wheel and cement them to the body.
11. Fit the body rest in position and cement it in place.
12. Tint if desired.
13. Apply a coat of wax and polish with a soft cloth.

PORTABLE TRACING BOX

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Bronx, N. Y.

Every shop teacher, at one time or another, has need for a tracing box in his school shop. Among its varied uses are the making of cloth and paper tracings, photograph retouching, and cutting stencils. The one shown in Figure 2 is a compact unit with convenient carrying handles, finger tip switch, an ink and pen tray, and an extension wire compartment obviating the nuisance of a tangling cord. This is how it is made.

After the material is cut for the stock bill list, and sawed to shape, the sides are butted to the front block and the back board. A good glue-up job is suggested here. The frame is rabbeted to ¼-in. depth with a ½-in. ledge all around the inside edge of the top frame. Assemble this as you would a picture frame. Mitered corners are desirable though not necessary. Glue this part in place. Finishing nails properly set will help fix it firmly while drying and add supporting strength to it afterward.

Fit the inside, back, and bottom panels in place. It is best secured when set in from the underside. Glue will suffice as a bonding agent.

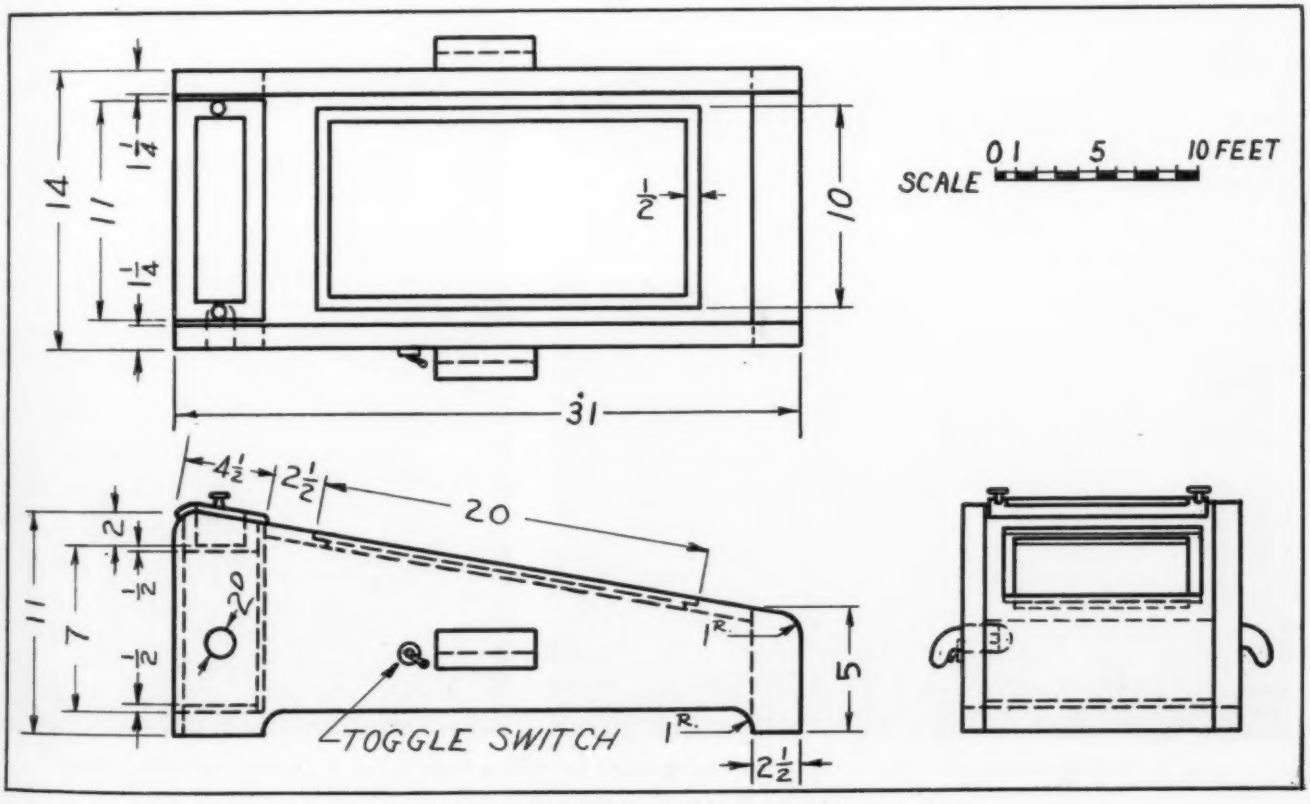


Fig. 1. Details of portable tracing box

BILL OF MATERIAL

No. of pcs.	*Name*	*Size*
2	Sides	1¼ x 11 x 31
1	Back	¾ x 11 x 11½
1	Front	2½ x 5½ x 11½
1	Frame bottom	¾ x 4 x 11½
1	Frame top	¾ x 2½ x 11½
2	Frame sides	¾ x 2½ x 24
1	Inside vert. panel	¼ x 5½ x 11½
1	Inside bot. panel	¼ x 3¾ x 11½
1	Tray	2 x 4 x 7¼
2	Handles	
1	Finger switch	
2	Small drawer knobs	
4	Rubber feet	
1	Tubular lamp, 10-in.	
1	Lamp socket	
1	Electrical flange plate	
1	Electrical nipple, 5-in.	
1	Electrical L joint	
1	Short socket nipple	
2	Plugs with prongs	
1	Plug with slots to fit prongs	
10 ft.	Extension cord	
1	24-gauge tin plate	11½ x 19½
	Necessary glue, screws, and nails	
1	Plate glass	¼ x 9⅞ x 19⅞

Cut the 2 by 4 block to fit easily into the opening left by the paneling and the back wall. A ledge is created around this block to prevent it from dropping into this well, by either framing it with quarter round molding, or by planing a rabbet cut all around and then rounding off the top side of the leftover ledge.

Plane the front edge block to a graceful curve. Drill a hole, large enough so that the slotted plug may be inserted and removed with ease when needed. Fit a pronged plug on the inside of the hole and back it up with a wooden block. Before it is set on permanently, sand the entire job to a fine finish. Fit the switch, the handles and the screw knobs in place, too. Remove it and prime and then paint the stand. A two-toned finish is very attractive.

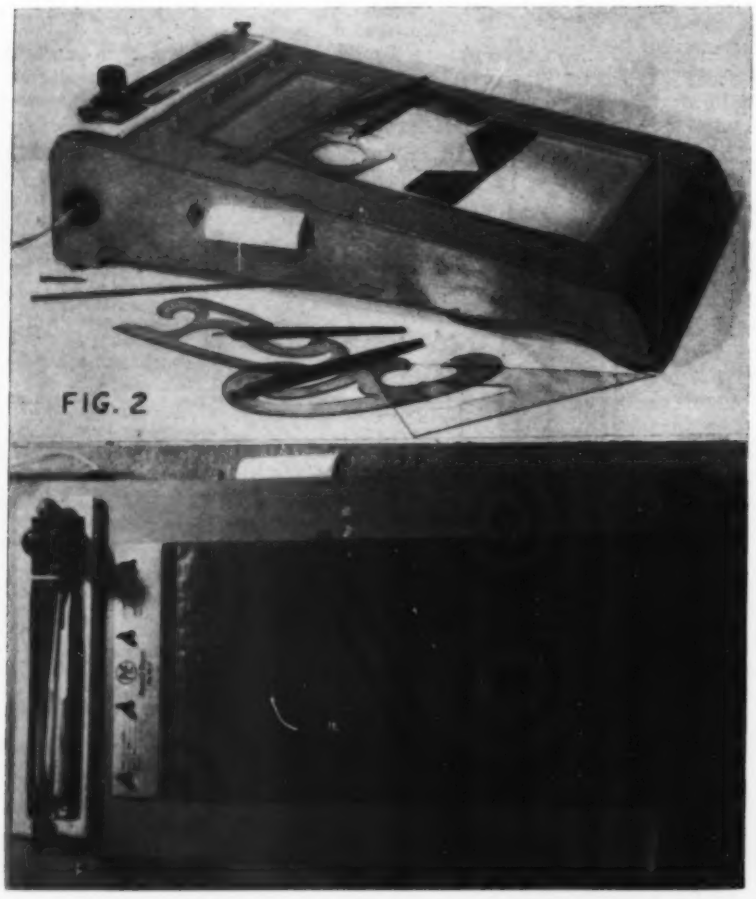
After the finish on the stand is entirely dry, it should be rubbed down and waxed, after which the hardware must be reset. Fit the electrical parts — the socket, flange, right-angle knuckles, wire, plugs, etc. — in place. Set the piece of tin over the bottom. Fold a hem all around the piece of tin, and screw it down so that it may be removed when necessary. This makes an excellent reflector.

Frost both surfaces of the plate glass window so that it will diffuse the light. This may be done by rubbing it with No. 9 emery dust made into a paste with kerosene or light oil. Use a felt pad wrapped over a block for applying the paste, and rub with a circular motion to avoid streaks. Be sure that all of the surface of the glass is treated this way. Check it by holding the plate up to the light after wiping off all sludge.

When this is finished, set it into its frame. To insure a snug fit, pack the edges with cotton soaked with litharge. Wipe off all excess for a clean joint.

Use a 10-in. tubular bulb for a good source of light. If the craftsman has the inclination and ingenuity he may resort to lumiline bulbs, neon tubing, or fluorescent light as a source of illumination.

Rubber screw tips, rubber buttons, or even metal slides attached to the feet of the stand will help stabilize it when it is in use. Four roundhead screws inserted above the glass will make this a very handy stand for cutting stencils.



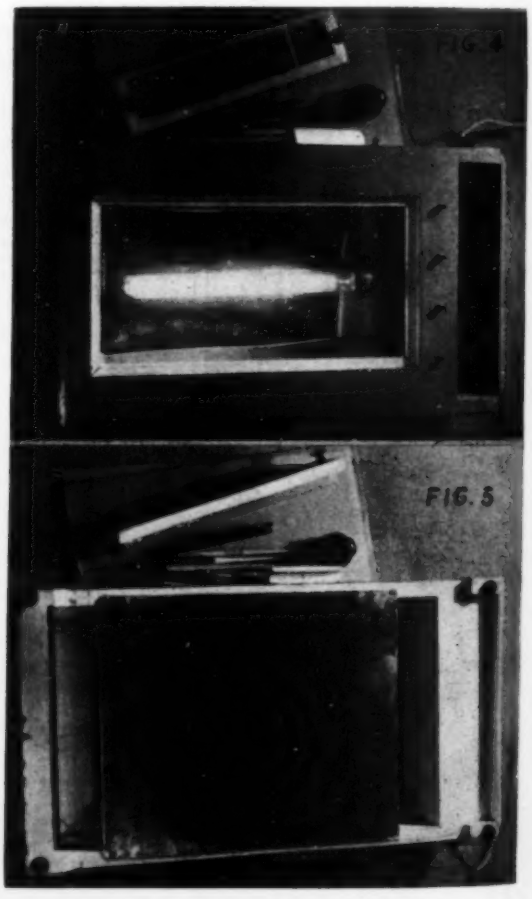


Fig. 2. Portable tracing box. Fig. 3. Using the tracing stand for cutting stencils. Fig. 4. Tracing box with tubular light installed. Fig. 5. Bottom view showing tin reflector

COLONIAL CHINA SHELF

HERBERT R. THOKE
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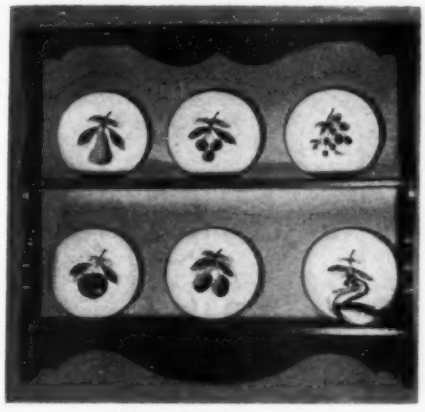
The china shelf, described in this article, can be adapted to several uses. The original was used to lend a hutch effect above a buffet.

The first one was made from home sawed sugar maple that was air dried for several years and then thickness planed to ⅝ in. However, ½-in. finished birch or northern hard maple will serve admirably, as will also some of the softer woods.

Make full size templates of the irregular curves, or lay them out directly on the stock.

To make the template rule off one-inch squares with a soft pencil and number them vertically and horizontally after which you will find it very simple to draw the irregular curves for the sides and front pieces.

The two sides can be cut as a unit on a scroll saw by placing the two pieces together and fastening them temporarily with small brads beyond the maximum length of the side to avoid nail holes within the job. If



Colonial china shelf

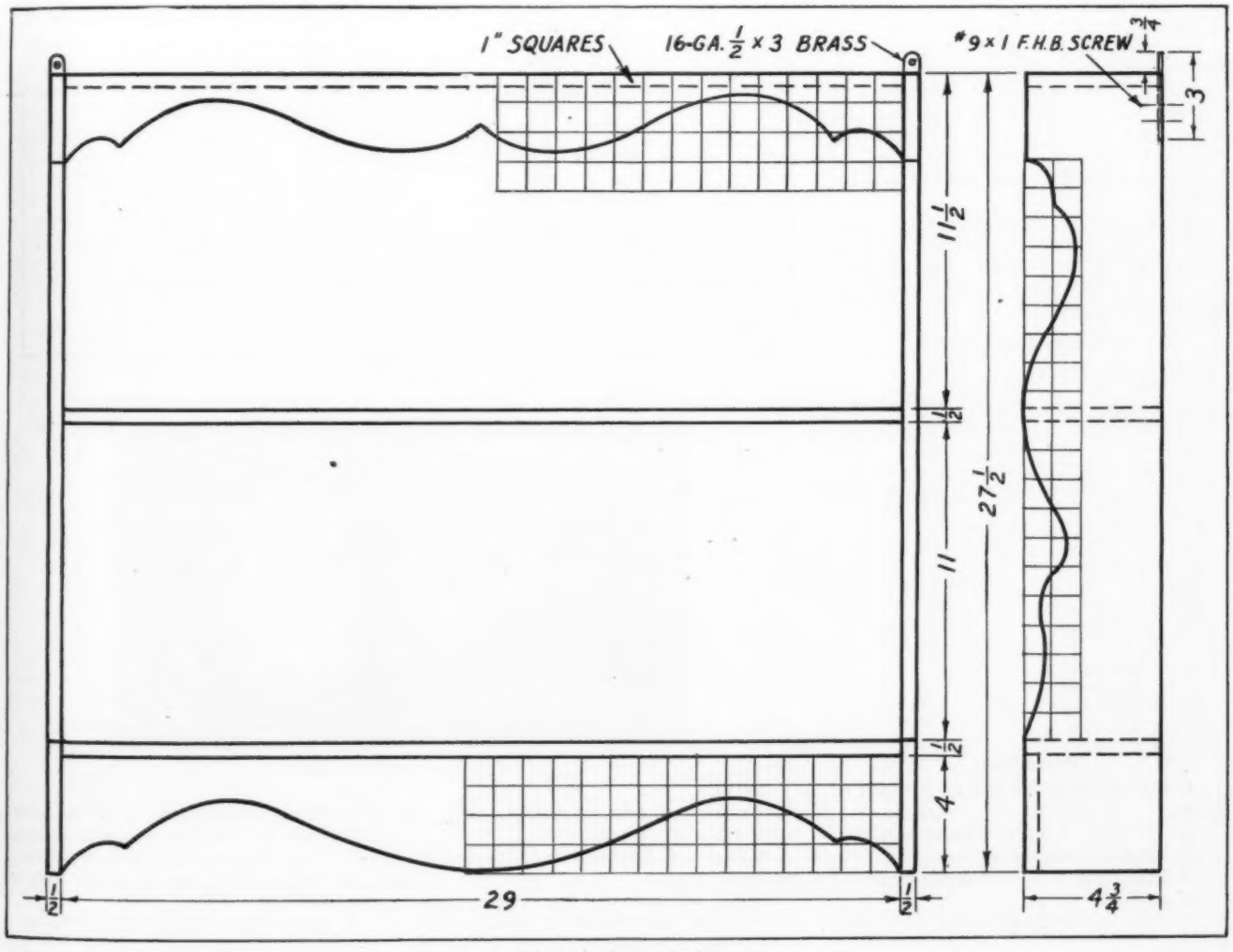
a small drum sander is available, they can also be sanded as a unit which will insure a greater degree of likeness. Blind dadoes are cut in the sides to support the top, middle, and bottom shelves.

To do this adjust the table saw to cut 3/16 in. deep. Use a ½-in. dado head, and cut from the back to within 1 in. of the front edge of each side. This will leave the forward cut of the dado sloping to the surface of the stock. The ends of the respective shelves are then shaped to fit roughly the sloping bottoms on the front end of the dadoes.

Note that the top front piece covers the edge of the top shelf and this will have to be considered when ripping the shelf stock. The bottom shelf front edge is exposed and is nailed to the bottom front scroll. Casing nails and glue are used to fasten the various pieces together.

Finishing

If maple or birch are used, a honey or golden maple stain will give gratifying results. Either a water or pigment wiping stain may be used, and with a little experimentation on scrap wood the desired tone can be obtained. If the shelf is to match some existing maple furniture, a little more time will be consumed to match color and tone. When a perfect match is desired it is a good procedure to apply the protective coating in the form of shellac and varnish to the sample patches.



Colonial china shelf

After two coats of varnish have been applied with plenty of time to harden, rub the surfaces with 3/0 steel wool to obtain a satin finish and end with a coat of paste wax.

Be sure to rub down the under surfaces of the top and middle shelves since they are very much in evidence, and should have the same soft finish as the rest of the wall shelf.

HUMIDOR

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The combination of wood, plastic, and metal, shown in Figures 1 and 2, makes a fine project. The plastic is either Plexiglas or Lucite fashioned to integrate with the general pattern of usefulness. The pipe support and base are of ¾-in. wood, whereas the cover is spun out of copper. The handle may be turned on a lathe from plastic or it may be an inexpensive drawer pull purchased in a variety store. The Plexiglas or Lucite cylinder is formed of ⅛-in. material.

This project calls for a frosted effect which may be obtained by sanding either or both surfaces of the Plexiglas or Lucite with a fine grade of abrasive cloth or paper. The same effect may be obtained by using the translucent type of plastic which can be purchased from the same sources as clear stock.

Many skills are involved in the making of this project, but it is one that combines usefulness with good design, and therefore, is in keeping with other smoking accessories found in the home.

BILL OF MATERIAL

No. of pcs.	*Name*	*Material*	*Size*
1	Cylinder	Plastic	⅛ x 8 x 17
1	Body band	Plastic	¼ x ½ x 18
1	Base	Wood	¾ x 8 x 15½
2	Pipe holders	Wood	¾ x 2½ x 7
1	Lid	Copper	18 gauge 6 ½ dia.
1	Handle	Wood or plastic	Selected
4	Screws, wood		No.6 by ½ F.H.B.
1	Screw (to fasten handle), R.H.		
	Wood finishing materials		
	Plastic cement		
	Plastic dye		

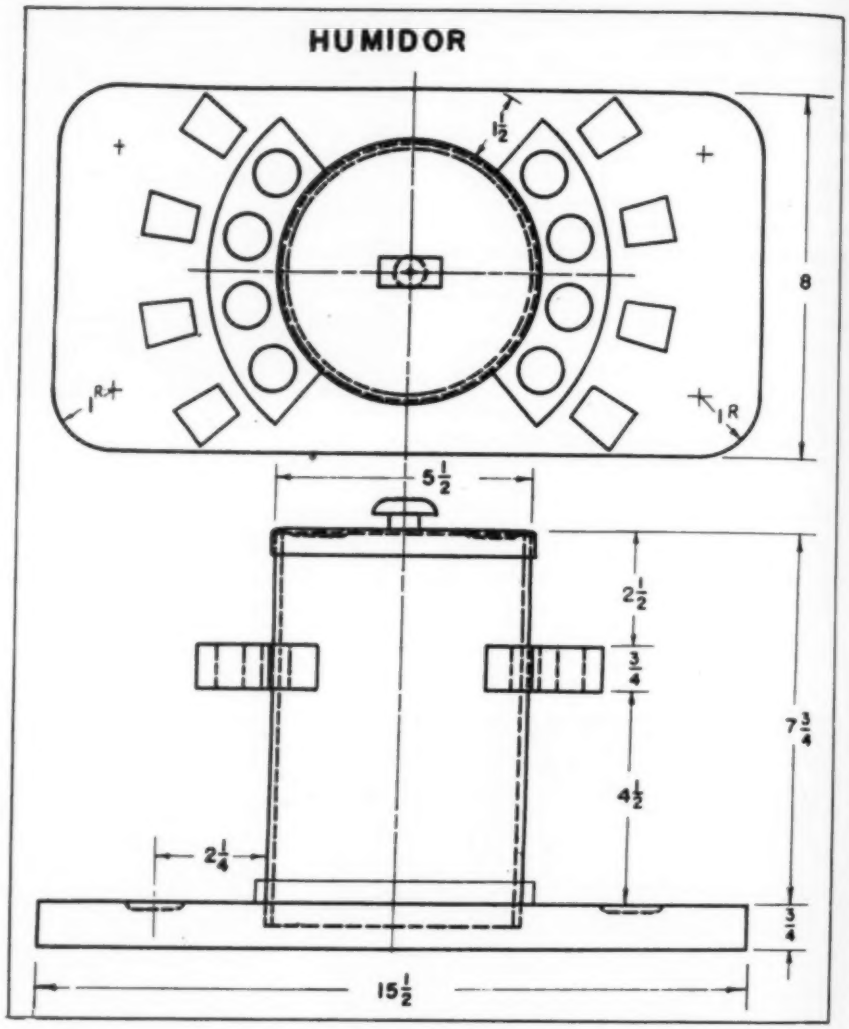

Fig. 1. Details of the humidor

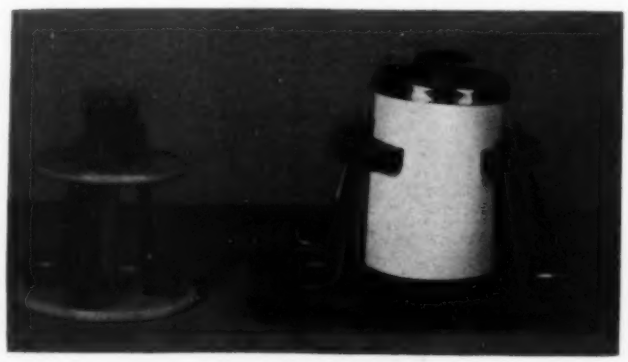

Fig. 2. The humidor

Procedure

1. Lay out parts full size on Plexiglas or Lucite.
2. Cut with a band or circular saw.
3. Plane and file the edges.
4. Heat and bend the body around a circular form.
5. File the adjoining edges and apply cement.
6. Sand the inside and outside of the plastic body with fine abrasive paper to produce a white, frosted effect.
7. Heat and bend the body band to fit the body.
8. File adjoining ends and apply cement.
9. Lay out and prepare all wooden pieces.
10. Apply a suitable finish to all wooden pieces.
11. Form the metal top to fit the plastic body. This may be done by metal spinning.
12. Make wood or plastic handle as desired.
13. Fasten the lid to the handle with appropriate screws.
14. Mark, center punch, and drill holes in the plastic body for fastening the pipe holders.

15. Assemble the pipe holders to the plastic body with wood screws.
16. Insert the plastic body into the groove in the wooden base.
17. Place plastic body band in position and apply cement.
18. Apply a coat of wax and polish with a soft cloth.

TOOL-BIT GAUGE

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The need for some kind of gauge or teaching aid is evident whenever a beginner first tries to sharpen a tool bit. It becomes even more evident when he resorts to the use of a bevel protractor in an attempt to check tool bit angles against information furnished by tool bit and toolholder manufacturers.

The gauge was designed to aid students in the sharpening of a series of the four tool bits, shown in Figures 1, 2, 3, and 4. These tool bits are used for doing general lathe work on elementary practice projects with cold-rolled steel. A feature of the design of this gauge is its simplicity and low material cost involving only a piece of .062 by 1¼ by 2-in. annealed spring steel.

Completion of the gauge by faster and more dexterous students prepares them for the grinding of tool bits, not simultaneously but progressively so that the instructor may devote more of his time to individual instruction at the grinding wheels where each student will use the gauge he has made in sharpening and checking his grinding efforts. Having satisfactorily sharpened his tool bits, the student is then prepared to begin work on his first elementary lathe project.

What the Gauge Is Designed to Do

1. The gauge is designed to increase accuracy and help teach proper tool grinding techniques.

2. It is designed to speed up grinding operations. There are no adjustments to make, and all that is needed is a toolholder for the specific bit and a reasonably level surface upon which to rest tool holder and gauge.

3. It is designed to prevent the waste of costly tool bits. In the sharpening of both the rough turning and the facing tool bit, every effort is made to keep the upper left corner (facing toward work) straight and parallel with both top and side surfaces of the bit. No additional front rake is used, the front rake of 19½ deg. provided as a built-in feature of the toolholders (Armstrong) being used. Resharpening of these two bits is done only at the end.

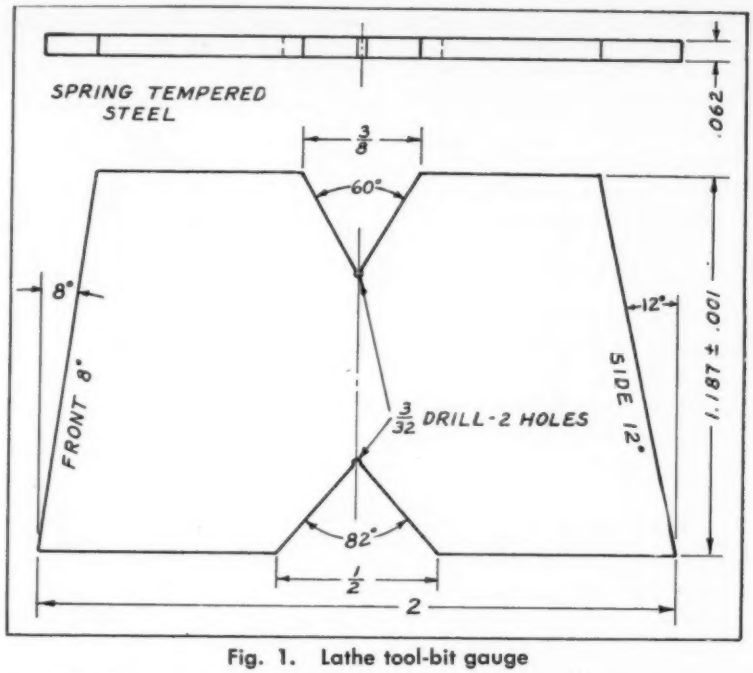

Fig. 1. Lathe tool-bit gauge

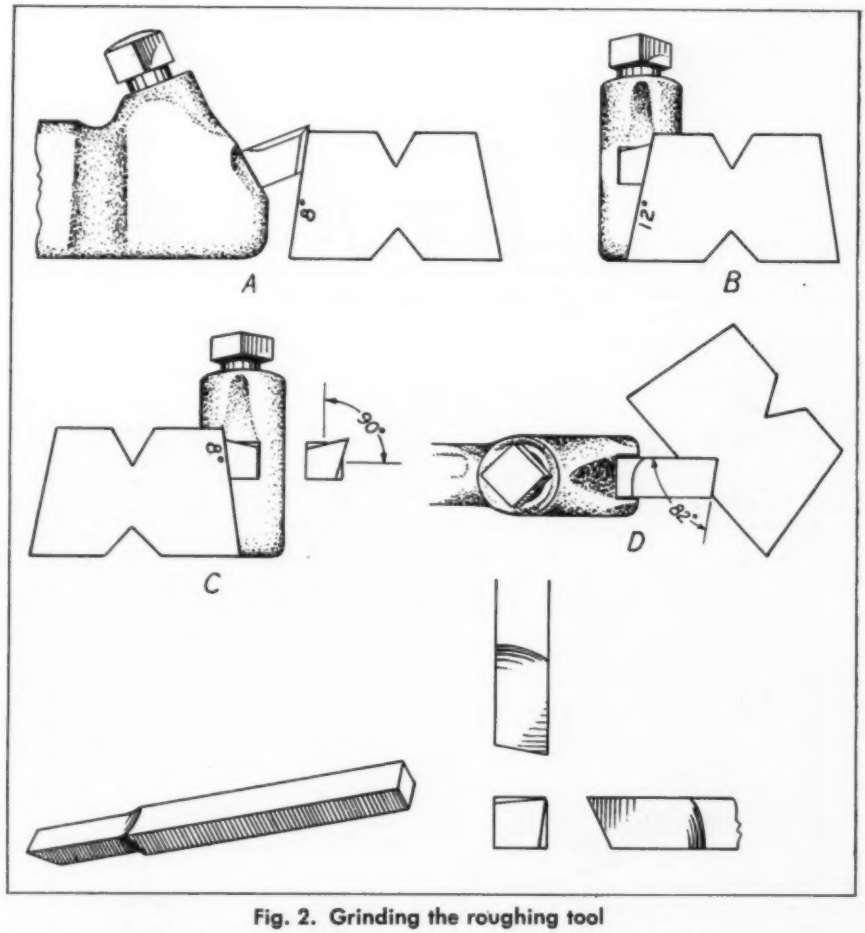

Fig. 2. Grinding the roughing tool

How the Gauge Is Used

1. *Rough turning tool bit.* Figure 2.

The tool bit is inserted into the tool bit holder so that it protrudes about ¾ in. The bit is fastened only finger tight. See *A*, Figure 2. The operator places the toolholder upon a flat surface so that the bit is pointed directly toward him. He then rests the gauge upon its longest edge and slides it toward the side of the bit from the right so that it touches the

side of the gauge marked 12 deg. See *B*, Figure 2. Sharpening is *not* done with the bit held in the holder, but is hand-held. Care is taken to maintain the upper edge along the length of the bit. The bit may be conveniently sharpened back from the end for about ¾ in.

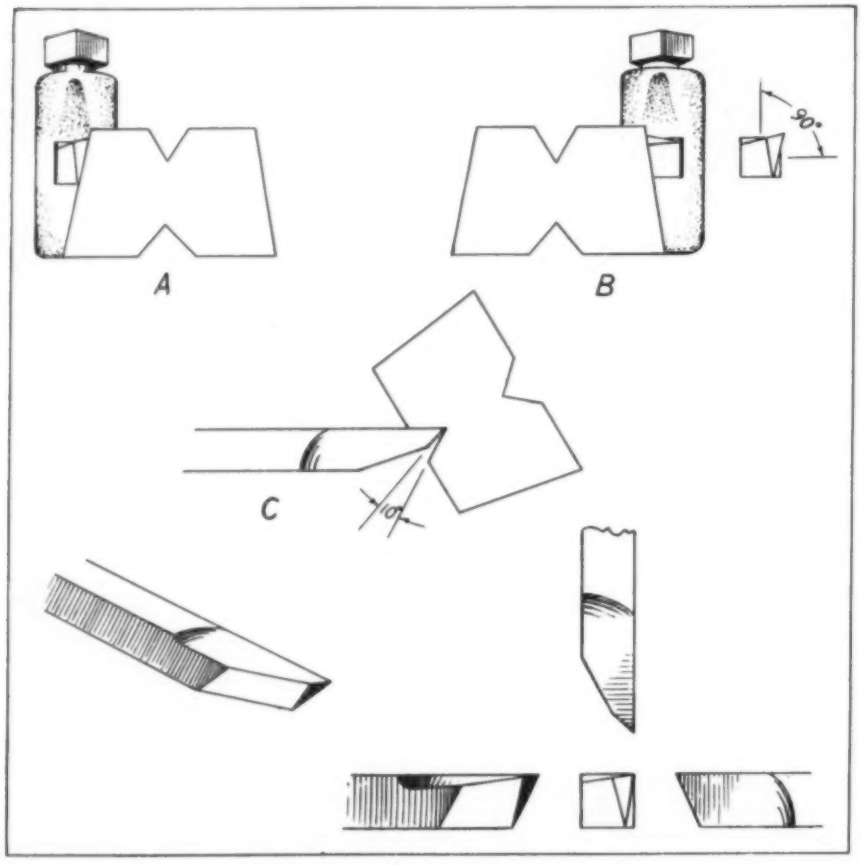

Fig. 3. Grinding the facing tool

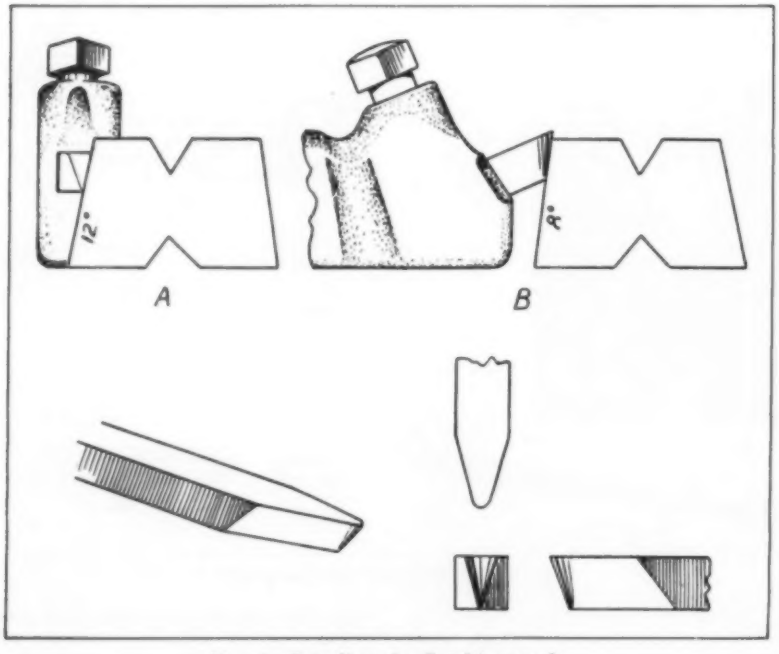

Fig. 4. Grinding the finishing tool

In the second operation, the bit is gauged from the left. A quarter turn is taken on the bit in the holder and there fastened so that the surface which will become the top is vertical on the left side. Gauging of top rake is then done by sliding the gauge on its longest edge toward the tool bit with the side of the gauge marked 8 deg. See *C*, Figure 2. When ground so that this surface and side of gauge coincide, a top rake of 8 deg. is provided. The toolholder is then turned so that the bit is pointed toward the right. The tool bit is removed and placed in position for checking the first 12-deg. grinding operation. See *A*, Figure 2.

The third grinding operation involves grinding a compound angle. The gauge must slide in from the right to the end of the bit with the edge of the gauge marked 8 deg., *A*, and, at the same grinding, the point of the tool should fit the *V* notch marked 82 deg., *D*, when the face of the gauge is in a horizontal position. This single grinding operation provides both vertical and horizontal clearance of 8 degrees for the point of the tool.

A radius of 1/64 to 1/32 in. may be ground on the point of the tool to prevent breakage and allow for a smoother cut. Edges may also be hand stoned.

2. ***Facing tool bit.*** Figure 3.

The first two grinding operations on the facing tool are performed exactly as for the rough turning bit. In the third operation, the tool bit is merely thinned down by removing the heel of the bit (a vertical grind without clearance) so that the flat point of the bit measures from 1/8 to 3/16 in. and tapering back toward the holder end for about ¾ in. The fourth and final operation consists of grinding an angle of less than 60 deg. (or about 50 deg.) on the point of the tool, using the gauge to maintain a clearance of 8 deg. See *C*, Figure 3. The notch marked 60 deg. can be used to assure an angle of slightly less than 60 deg.

3. ***Finishing tool.*** Figure 4.

This tool can be used for finish turning on light cuts toward either left or right or may be used to turn a radius in either direction. The sides of the tool (just back of the round nose) may be used to break edges or cut a chamfer.

To sharpen this tool, the point may be thinner to ¼ in. or less, tapering from both sides from 1 or 1½ in. from the end. The top face is ground perfectly flat without top rake in either direction. The 12-deg. side of the gauge is used to maintain side clearance on both left and right side, *A*, Figure 4. A front clearance of 8 deg. is used for the rounded point of this tool, *B*, Figure 4.

4. ***Threading Tool.*** Figure 5.

This tool is designed for use in the ordinary straight turning holder, when the bit is set at 19½ deg., if a spring toolholder is not available. It must be remembered that this gauge was made to fill the needs of a specific tool post setup. In this case there was a distance of 1.187 in. vertically from the top of the rocker to the centerline of the headstock spindle, so the height of this gauge was made that distance with use of a 3/8-in. tool bit

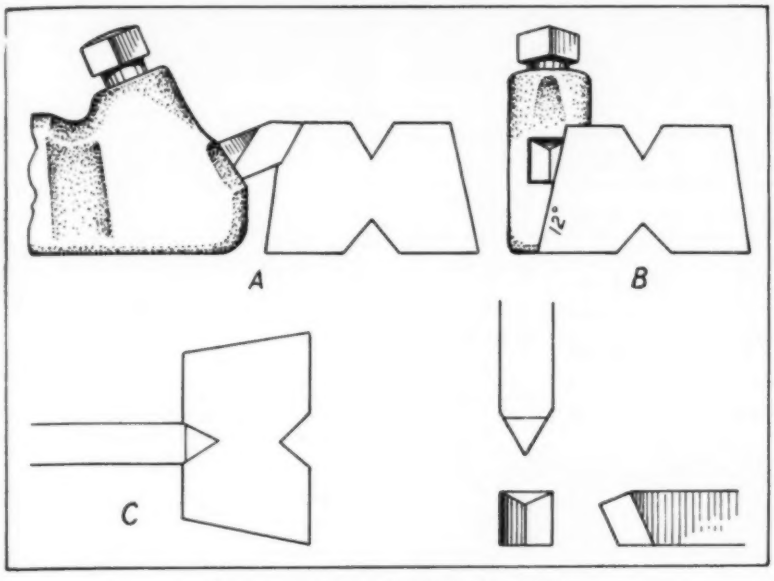

Fig. 5. Grinding the threading tool

holder. Others using this gauge idea are cautioned to use a gauge width suitable for their particular lathe setup. Adjustment to some degree is possible by sliding the thread tool bit either farther in or out of the holder, by using higher or lower rocker, a thicker or thinner tool post ring, or blocking up the toolholder by placing shims on top of the rocker and under the toolholder. In this case, it is wise to grind the top facet of the thread bit in a surface grinder so that a surface of about ½ in. is made which is parallel to the under surface of the toolholder. Caution here, too, is urged in blocking the toolholder or fastening to an angle iron with a wide base while grinding on the surface grinder.

The second operation involves the grinding of one side of the point of the thread tool at an angle of 30 deg. and maintaining a side clearance of 12 deg., *B*, Figure 5.

The third operation, and most precise, involves the grinding of the opposite side of the point to get an angle of exactly 60 deg. while maintaining a side clearance angle of 12 deg., *C*, Figure 5. Both edges of this bit should be carefully hand stoned.

Suggested Procedure for Making Gauge

1. Use .062 by 1¼ by 2-in. annealed spring steel.
2. Cut off and file to 2-in. length. See Figure 1.
3. File to 1.187-in. width. It is important to keep these edges parallel if gauge is to be used as a center gauge for setup for third cutting.
4. Lay out and file 12-deg. angle. Check closely with protractor.
5. Lay out and file 8-deg. angle. Check closely with protractor.
6. Scribe center line of gauge and lay out both 82-deg. and 60-deg. angles.
7. Center punch and drill hole at vertex of each of these angles.
8. File out angles accurately — especially the 60-deg. angle, making sure that it is set exactly at right angles to longest edge of gauge if it is to be used as a setup gauge in lieu of center gauge.
9. Stamp on angle designations. Do not stamp deeply as it has a tendency to distort gauge.
10. Harden and grind flat surfaces.
11. Stone all gauging edges to remove scale or correct minor distortions.

CENTERING PICTORIAL DRAWINGS

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The accurate centering of a pictorial drawing has always been a problem for the draftsman. His usual solution has been to make a rough outline drawing of the object in order to determine the area his pictorial drawing will occupy on the sheet of drawing paper.

Below are given formulas by means of which one can calculate rapidly and accurately the area the pictorial drawing will occupy on the sheet.

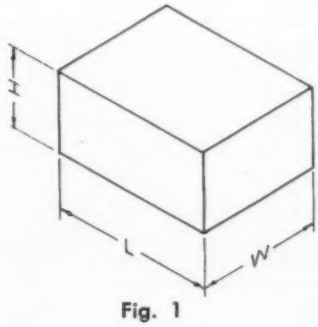

Fig. 1

Formulas for centering isometric drawings and oblique drawings of both cavalier and cabinet type are given.

To facilitate an understanding of the formulas the following symbols are used throughout this article.

L — Actual length of the object, Figure 1.
W — Actual width of the object, Figure 1.
H — Actual height of the object, Figure 1.
TH — The total height the pictorial drawing will require, measured vertically, Figure 2.
TL — The total length the pictorial drawing will require, measured horizontally, Figure 2.

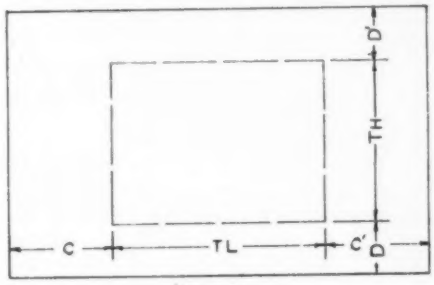

Fig. 2

1. To calculate the total length (TL) of the drawing use the formula:

$$TL = (W + L) \times .866$$

2. To calculate the total height (TH) of the drawing use the formula:

$$TH = \left(\frac{W + L}{2}\right) + H$$

Now the rectangular area to be occupied by the isometric drawing is known. Center this rectangle on the sheet, Figure 3, making C equal to C′ and D equal to D′.

3. To locate the starting point X of the isometric drawing, Figure 3, divide the width by two and measure upward from O, locating point P.

From point P draw a 30-deg. line until it intersects the base line of the rectangle. This intersection locates point X.

Now the isometric drawing may be constructed as in Figure 3.

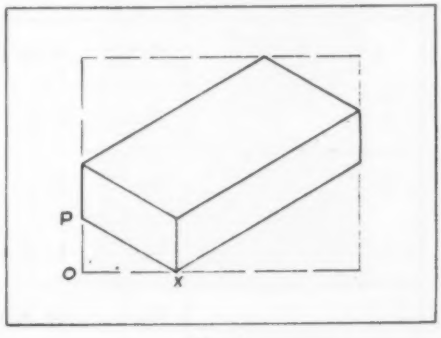

Fig. 3

If the object is cylindrical, apply the method just described. For L and W use the actual diameter of the cylinder. It will be

found that although the pictorial drawing does not occupy the complete rectangular area calculated by the formula the reduction is equalized at A and A′ and B and B′, thus leaving the drawing centered, Figure 4.

Using formulas based on the same principle as the one developed for isometric drawings it is possible to center an oblique drawing on a sheet by selecting the angle of the receding side and referring to Table I.

Receding Angle		Cavalier Oblique	Cabinet Oblique
7½°	TH	$H + (W \times .13)$	$H + \left(\frac{W \times .13}{2}\right)$
	TL	$L + (W \times .99)$	$L + \left(\frac{W \times .99}{2}\right)$
15°	TH	$H + (W \times .259)$	$H + \left(\frac{W \times .259}{2}\right)$
	TL	$L + (W \times .966)$	$L + \left(\frac{W \times .966}{2}\right)$
22½°	TH	$H + (W \times .383)$	$H + \left(\frac{W \times .383}{2}\right)$
	TL	$L + (W \times .924)$	$L + \left(\frac{W \times .924}{2}\right)$
30°	TH	$H + (W \times .5)$	$H + \left(\frac{W \times .5}{2}\right)$
	TL	$L + (W \times .866)$	$L + \left(\frac{W \times .866}{2}\right)$
37½°	TH	$H + (W \times .609)$	$H + \left(\frac{W \times .609}{2}\right)$
	TL	$L + (W \times .793)$	$L + \left(\frac{W \times .793}{2}\right)$
45°	TH	$H + (W \times .707)$	$H + \left(\frac{W \times .707}{2}\right)$
	TL	$L + (W \times .707)$	$L + \left(\frac{W \times .707}{2}\right)$
52½°	TH	$H + (W \times .793)$	$H + \left(\frac{W \times .793}{2}\right)$
	TL	$L + (W \times .609)$	$L + \left(\frac{W \times .609}{2}\right)$
60°	TH	$H + (W \times .866)$	$H + \left(\frac{W \times .866}{2}\right)$
	TL	$L + (W \times .5)$	$L + \left(\frac{W \times .5}{2}\right)$
67½°	TH	$H + (W \times .924)$	$H + \left(\frac{W \times .924}{2}\right)$
	TL	$L + (W \times .383)$	$L + \left(\frac{W \times .383}{2}\right)$
75°	TH	$H + (W \times .966)$	$H + \left(\frac{W \times .966}{2}\right)$
	TL	$L + (W \times .259)$	$L + \left(\frac{W \times .259}{2}\right)$
82½°	TH	$H + (W \times .99)$	$H + \left(\frac{W \times .99}{2}\right)$
	TL	$L + (W \times .13)$	$L + \left(\frac{W \times .13}{2}\right)$

Table I

For H, W, and L substitute the actual dimensions of the object to be drawn. Then calculate the total length (TL) and total height (TH) distances.

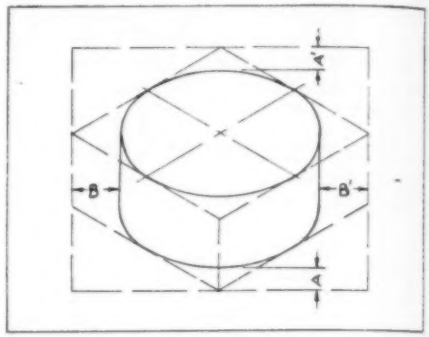

Fig. 4

Example No. 1: To center a cavalier oblique drawing of an object 3 in. long, 2 in. wide, and 2 in. high with a receding angle of 30 deg.

1. From Table I we find under the 30-deg. receding angle that $TH = H + \frac{W}{2}$. Substitute 2 in. for H and 2 in. for W and then work as follows: $TH = 2 + \frac{2}{2}$

$= 2 + 1$ in.

$= 3$ in.

2. Table I also shows that

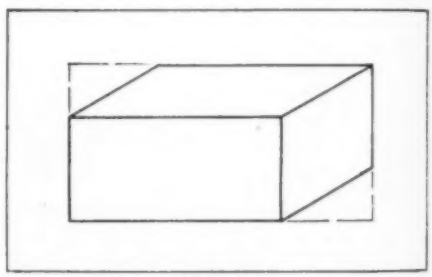

Fig. 5

$TL = L + (W \times .866)$.

Substitute 3 in. for L and 2 in. for W and work as follows:

$TL = 3 + (2 \times .866)$

$= 3 + 1.732$ in.

$= 4.732$ in.

3. The area to be occupied by the oblique drawing is 3 in. high and 4.732 in. long. Center this area on the sheet as shown in Figure 5, and construct the oblique drawing.

Example No. 2: To center a cabinet oblique drawing of an object 3 in. long, 2 in. wide, and 2 in. high with a receding angle of 30 deg.

1. Under the 30-deg. receding angle, in Table I, find that $TH = H + \left(\frac{W \times .5}{2}\right)$.

2. Find there also that

$$TL = H + \left(\frac{W \times .866}{2}\right).$$

This formula is possible because the receding sides of a cabinet oblique drawing are drawn to half the scale of the front face.

Conclusions

The various formulas given can be applied to any symmetrical oblique or isometric drawing and to many asymmetrical objects. For many asymmetrical objects it is limited in its use. However, it is possible, after becoming acquainted with the principles involved, to utilize these principles for centering asymmetrical objects.

INSTRUCTION SHEET — MAKING A SHEET-METAL WASTEBASKET

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Purpose: In making this wastebasket you will become familiar with the circular double seam. It also will give you experience in wiring and grooving.

Procedure: Write and complete the following statements in your notebook.

The wastebasket is to be made of.....

The size of the wire is.....

The allowance for this wire is.....

The No. of the template to be used is.....

The name of the seam in the side is .....

The width of this seam is.....

The name of the seam at the bottom is .....

The width of this seam is.....

The tools and machines to be used are as follows: (Spelling must be correct.)

1.	10. .....
2.	11. .....
3.	12. .....
4.	13. .....
5.	14. .....
6.	15. .....
7.	16. .....
8.	17. .....
9.	18. .....

Now write, in your notebook, the notes on *double seaming*. Also, make a drawing of the steps. Report.

Layout and Cutting

A. Check out the template and ask the instructor where to cut out the metal you will need. Weight the template down with lead blocks, and mark around it with a scratch awl. See Figure 1.

FIG. 1

B. Cut along the two curved lines with straight snips. Then cut about ⅛ in. *outside* the straight lines. Then take the piece to the squaring shears and cut *on* the straight lines. Then notch the corners.

C. Have the instructor check your work.

Forming Body

A. Set bar at 5/16 in., and turn the straight edges to an open hem in opposite directions.

B. Adjust the rolls as directed in making the quart cup. Look up these directions.

C. Start the piece through, single edge down, curving it first, as was done with the quart cup. Start the metal through the machine so the edge will be parallel to the roll. See Figure 2.

FIG. 2

D. As the piece is rolled through, slide it sideways enough so the end will come out parallel with the rolls, as shown in Figure 3.

E. Complete the rolling and have the instructor check your work.

FIG. 3

F. Hook the edges and place the seams on the hollow mandrel stake.

G. Get a No. 4 groover and mallet. Lock one end of the grooved seam, as shown in Figure 4.

FIG. 4

FIG. 5

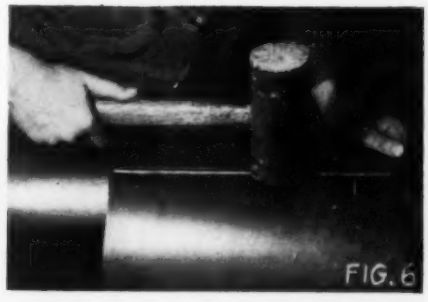
FIG. 6

H. Lock the other end as shown in Figure 5, and finish grooving.

I. Strike lightly along the seam with mallet only, to tighten it. See Figure 6. This is called *dressing*.

J. Show your work to the instructor.

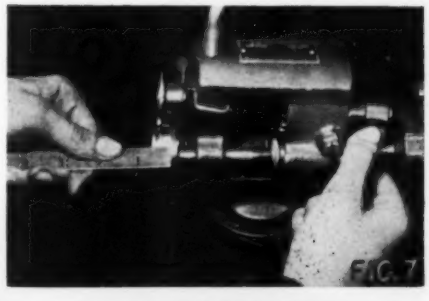
FIG. 7

FIG. 8

Turning Wire Edge

A. Set up the turning machine. Set the gauge so the distance from the gauge to the center of the groove will be equal to the wire allowance. Hold the rule as shown in Figure 7.

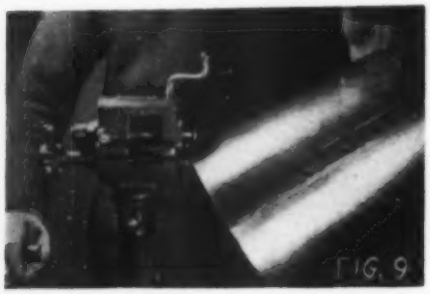
FIG. 9

FIG. 14

FIG. 10

B. Place the top of the basket between the rolls and tighten the crank screw lightly. Hold left hand as shown in Figure 8.

C. Adjust the wastebasket to the angle shown in Figure 9, and make one revolution with the machine. Hold left hand steady, allowing metal to slide over it.

D. Raise the wastebasket, as shown in Figure 10, and make a second revolution.

E. Raise it again, as shown in Figure 11, for the last revolution.

F. Round up the top of the wastebasket and report your work to the instructor.

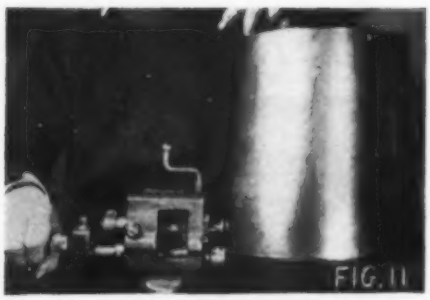
FIG. 11

Wiring the Edge

A. With a circumference rule, find out how much wire is needed. See Figure 12.

B. Cut a piece of wire to the correct length using Button's pliers.

C. Straighten the wire with a hammer, not a mallet, on a bench top, not an anvil, as in Figure 13.

D. Form the wire by passing it through the grooved part of the forming rolls. See Figure 14.

E. Report the forming of the wire to the instructor.

F. Lock one end of the wire in place in the turned edge of the wastebasket, as shown in Figure 15. Use Button's pliers. Do this same thing in several other places around the top.

G. If necessary, force the wire down in the edge by striking it with the peen of the hammer. See Figure 16.

H. With the face of the hammer, bring the edge down as shown in Figure 17. *Don't*

FIG. 12

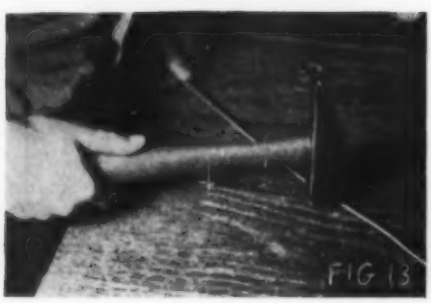
FIG. 13

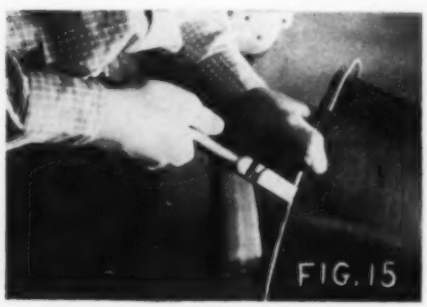
FIG. 15

FIG. 20

FIG. 21

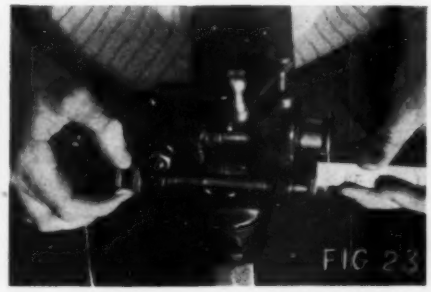
FIG. 23

FIG. 25

try to bring it around the wire; just bring it over far enough so the machine will catch it.

I. Place the edge in the machine and bring the top roll down at a place where the metal fits against the wire. See Figure 18.

placed in the machine as in Figure 22. If you can do this you are *good*.

Burring Out the Lower Edge

A. Set the burring machine so the distance from the gauge to the edge of the upper

Use your hands as shown in Figures 27 and 28.

F. Test the bottom for roundness with a rule, held as shown in Figure 29, measuring across from outside to outside of the burred edge, in about four different positions. When these measurements are the same in all

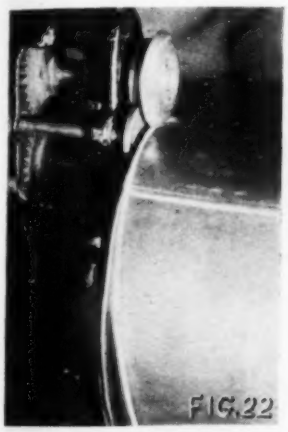
FIG. 22

FIG. 24

FIG. 30

FIG. 31

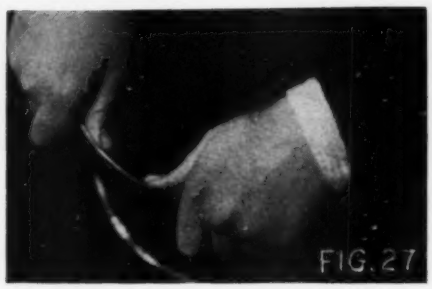
FIG. 27

FIG. 28

J. Move gauge up against the edge and lock it with the lock nut. See Figure 19.

K. Back the crank screw up a turn or two and make a revolution of the basket about as horizontal as in Figure 20.

L. Tighten the crank screw and raise the wastebasket to the angle of Figure 21, and make a second revolution. This should finish the enclosing.

M. Report the finishing of the wiring to the instructor.

NOTE: Sometimes you may be able to turn the edge far enough with the turning machine so the wiring machine will catch the edge *without* first bringing it down with the hammer. The wastebasket would then be

roll will be equal to the width of the double seam. Look at Figure 23.

B. Place the lower edge of the wastebasket in the machine and set the roll down with the crank screw, medium tight. Hold the left hand as shown in Figure 24. Compare Figure 24 with Figure 8.

C. Make one revolution of the wastebasket, holding it in a horizontal position, as shown in Figure 25, holding the left hand steady and allowing the wastebasket to slide through it.

D. For the second revolution raise the basket to the angle shown in Figure 26.

E. After burring, the bottom must be trued up, or forced back to a circular shape.

positions, you are through. Make a note of this measurement. Report to the instructor when you have finished burring.

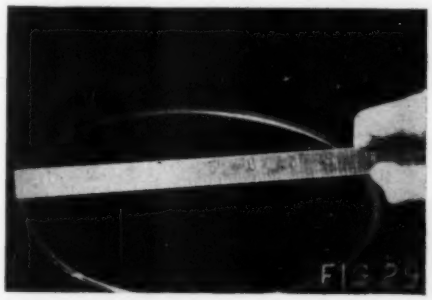
FIG. 29

FIG. 32

FIG. 33

FIG. 34

FIG.

Cutting and Burring the Bottom

A. Work out the following problem in your notebook: Write down the measurements of Step *F*, above. To this add twice the width of the double seam. Divide this sum by two.

B. Show your solution of this arithmetic problem to the instructor.

C. Set a compass to the distance just calculated above, and draw the circle on the metal your instructor will give you.

D. After drawing the circle measure its diameter with a rule to see if it is right. Then cut it out.

E. Show the disk to your instructor.

F. The burring of a disk is one of the hardest operations in the sheet-metal shop. Read over the next seven steps. Look at the pictures carefully, and then get your teacher to show you how it is done.

G. The disk is pinched between the thumb and first two fingers, as in Figure 30.

H. The hand is placed against the machine as in Figure 31.

I. The disk is brought up between the rolls, and the upper roll brought down on it as in Figure 32.

J. The crank is turned enough to make one revolution of the disk as in Figure 33. Note the disk is about horizontal.

K. For the second revolution raise the disk as in Figure 34. Note that the first two fingers are used to push against the disk.

L. The disk will always pucker up and must be straightened by slapping it down on a bench real hard as shown in Figure 35.

M. Now set up the burring machine, and adjust the gauge to the width of the double seam and have your teacher demonstrate to you how to perform this operation.

FIG. 36

FIG. 37

FIG. 38

FIG. 39

Double Seaming the Bottom

A. Snap the bottom in place as in Figure 36.

B. Rest the basket on the edge of a bench and start the burred edge over with the face of a setting hammer. Don't try to set it down; just start it over a little. See Figure 37.

C. Set down the burred edge as shown in Figure 38. Have your teacher demonstrate.

FIG. 40

FIG. 41

FIG.

Don't chop down on the end of the peen as shown in Figure 39. Be sure to use a setting hammer, not a riveting hammer.

D. Report the setting down to your instructor.

E. Now set down the edge with a mallet.

Use a double seaming stake. There are two parts to this step. First, bring the edge over about halfway as in Figure 40, holding the mallet at an angle of about 45 deg., going entirely around the wastebasket. Second,

bring the edge clear down, holding the mallet straight up as in Figure 41. *Don't strike hard blows.*

F. Dress the edge to remove the bulge or convexity of the bottom and to square up the edge, as in Figure 42.

G. Test the bottom by holding a rule on it as in Figure 43. It should be slightly concave; that is, there should be a little space between the rule and the center of the bottom.

H. Report the finishing of the wastebasket.

Finishing

A. Begin brushing enamel on the bottom of the basket. See Figure 44. Stroke *out* over the edge, not *in.*

B. Cover the double seam by stroking around the bottom. See Figure 45.

C. Do the sides. Start at the double seam and stroke as shown in Figure 46. *Don't stroke across the double seam as in Figure 47.*

D. Begin at the wired edge and stroke up. See Figure 48. Don't try to cover the wired edge.

E. Stroke out the enamel evenly and let dry without moving it.

F. When this much has dried, turn the basket over. Cover the wired edge, and about ⅓ of the way down on the inside of the basket. Don't stroke across the wired edge. Stroke around the basket, along the wire, as in Figure 49.

G. When dry, report the brushing.

MACHINE BUILDING PROGRAM IN HIGH SCHOOL

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The William Cullen Bryant High School offers a machine building program in its machine shops.

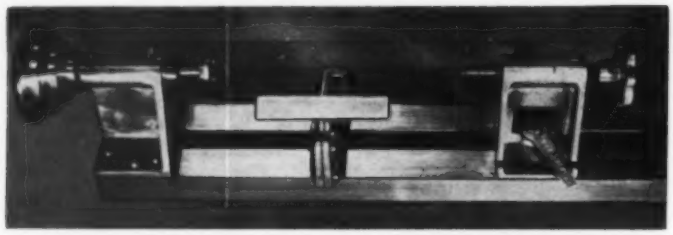
The students make a small wood lathe for themselves. The machine is of simple design, sturdy, and so constructed that attachments such as a sander, jig saw, grinder, buffer, wire wheel, and circular saw are easily attached.

Students start with the basic design and if they show ability are permitted to make a more advanced design.

We start the cycle of manufacture much as is done in industry, giving designing, drawing, patternmaking, foundry, machine shop, electric shop, and woodworking all on an industrial-arts basis.

We expect to build motors to go with these machines. A ⅛-h.p. motor will run this machine very well.

In the woodshop the student learns how to



Showing screw-type tailstock center

run woodworking machines which he later makes. He may also build a workbench for mounting the machine though any sturdy table will support it.

The job sheets are made to fit the needs of an industrial-arts program in our senior high school. About half of the class of 25 students works on the lathe project while first termers make an assorted variety of industrial-arts projects. We feel that in most cases the job sheets represent the best way to carry on our work. We are fully aware that industry and other elaborately laid-out school shops would do many operations in a different way.

In our machine shop the students are taught how to use 116 different tools on the lathe project. We have 1 lathe (quick-change, engine), 2 drill presses, 1 wet grinder, 1 bench grinder, 1 4-in. bench shear, 1 sheet-metal brake, 20 vises, 1 anvil, 2 position molding tables, 3 bench furnaces, a few portable electric tools, and a triple unit gas furnace.

We melt aluminum in a gas fired furnace which has a size 10-or 12 crucible melting pot capacity.

About 6 lb. of aluminum scrap are needed to make the castings for the lathe exclusive of attachments.

If patterns can be made (this lathe requires only an elementary knowledge of patternmaking), castings may be obtained for a small cost from an outside foundry.

Aluminum is more expensive but easier on the tools and easier to cut. Cast iron is much cheaper, stronger, but harder to cut. The pattern shop can make metal and production-type patterns such as match plates, gated patterns, and flasks for the foundry unit.

The casting method of machine manufacture is nearly always the most efficient. Because pattern manufacture can become involved for beginners, simple design is very essential.

If we had a technical or vocational department in our school I would run the program on a larger scale. In a technical course I would have the students design the lathe in a variety of ways and perhaps add a metal cutting carriage and ball bearings to the headstock. In the vocational course the machine could be larger and made to be used in the school woodshop. They could be made on a production basis. Jigs, dies, and fixtures for its manufacture could be made.

We plan to construct other machines and combinations of machines as we work into this program.

It is our intention to keep the regular non-lathe jobs in our course for those who haven't the ability or the time to do machine building.

Reasons for Incorporating Machine Building Projects

1. The students like the idea of making machines.

2. The continuity of the work tends to keep students interested.

3. Definite goals provide an incentive to complete the projects.

4. Negligible loss of metal. Defective castings are remelted. Students replenish stock pile with a specified amount of scrap aluminum.

5. Shop subjects are taken as electives and, therefore, some unit of work was sought which would attract students to the shops.

6. It was the wish of the teacher who happens to be a licensed instructor in woodworking, patternmaking, mechanical drawing, and machine shop, to design machines simple enough for the average high school student. It was felt that the average design as used in industry, was too complicated for the inexperienced student in high school.

7. The lathe as set forth is in its simplest state. Unlimited room is left to expand on design and details. Thus, the individual differences of pupils can be satisfied.

8. The cycle of machine construction can be taught better when it is followed in actual practice in the schoolroom.

9. The need was felt to have incorporated in one project a large percentage of the material which it is believed a high school student who takes shop and drawing is expected to know. For instance, the grinder washer was designed to teach the student how to lay out an octagon. Hence, the teacher is in a better position to know that he is covering a well-planned course of study when but one job is followed, than when assorted jobs are given.

10. If all of the shop subject classes as drawing, woodworking, patternmaking, foundry, machine shop, sheet metal, and electrical, embrace such a machine building program, much overlapping can be avoided.

11. Projects provide a great wealth of prevocational experience, thus meeting a very important objective of industrial arts.

12. Pulsation of industry is felt and respect for labor transferred.

13. Experiment in industrial arts does not end for student with his high school career. A lathe with attachments and motor has value in providing him with a means for a worthy use of leisure.

14. Good citizenship training promoted by realization of need for co-operation. *Example:* Students bring in scrap metal. This also teaches conservation of material.

15. Transfer of mechanical and handyman techniques to situations in home plus other values makes for *worthy home membership.*

16. Health is promoted through mental and physical activity in shopwork.

17. Fundamental processes are taught and the student learns how to take a methodical approach to practical problems.

18. Vocational and technical shops could use this type of project nicely; however, some changes may be desired.

19. Related subjects may be added, thus bringing the academic and the practical subjects closer together.

Procedure Followed in Building Lathe and Attachments

Shopwork may be taken for up to four terms in high school. Time spent in shop, two periods daily for 1½ hours, every day. One-, two-, three-, and four-term students are mixed in the classes at one time. We cannot separate the terms into classes due to program difficulties. Some advantages accrue from this policy as there are fewer bottlenecks at machines; more students can take shop and advanced students can help beginners.

Term 1. Making hand tools, lamps, rings, tie clips, casting art metal, etc.

Term 2. Building wood lathe and other projects.

Term 3. Complete lathe, guards, turning tools, faceplate, sander attachment.

Term 4. Jig saw and/or circular saw attachments.

Time required. One student made the lathe parts 1 to 12 in eight weeks, including all casting work. Usual time required almost two terms.

Students take lathe home on completion. In return, however, 6 lb. of scrap or ingot aluminum must be given school by student.

Sander and other attachments are not to be started by any student until his lathe is completed and accepted.

Each job sheet must be copied by the student prior to working on part. This policy pins the student down on safety and procedure and gives him the sequence without waiting for the teacher. Even the teacher would be likely to give the incorrect sequence while under classroom stress.

These job sheets only help the students. Much thinking on the part of the pupil is still required.

Lessons are given on major topics. These are quite lengthy. Most lessons are short spot lessons as "cleaning a file." Lessons about milling machines, for instance, which we do not have in the shop, are given by using trade magazines or films. We have to file flat surfaces smooth and straight.

Lessons are followed and to be certain that the students are taught the essentials, a "Delaney" book card system is used. When

the lesson has been given the card is turned over and the date noted. Thus the teacher can be sure he has given the lesson even if it has not been in sequence.

As most students progress at a different rate of speed, lesson information is not used as soon after it is given as is desired.

A lesson on the teacher's lathe model is given each term. A bowl or lamp is made and attachments demonstrated. Thus, the teacher proves that the lathe is sturdy and a good job can be turned out on it. Also, student interest is renewed.

Cost to student *at most* would be: belt, 75 cents; screws, 20 cents; metal scrap or ingot, $1.50; pair of pulleys, $1.50; motor, $10.

Course is enlivened with contests, problems, reading periods, films, outside information and material, school jobs and special work.

The teacher should alter the job sheets to fit the situation in his shop. These job sheets could be used as a guide for the teacher only. Thought-provoking questions, motivation, and student-written job sheets could be included in the program.

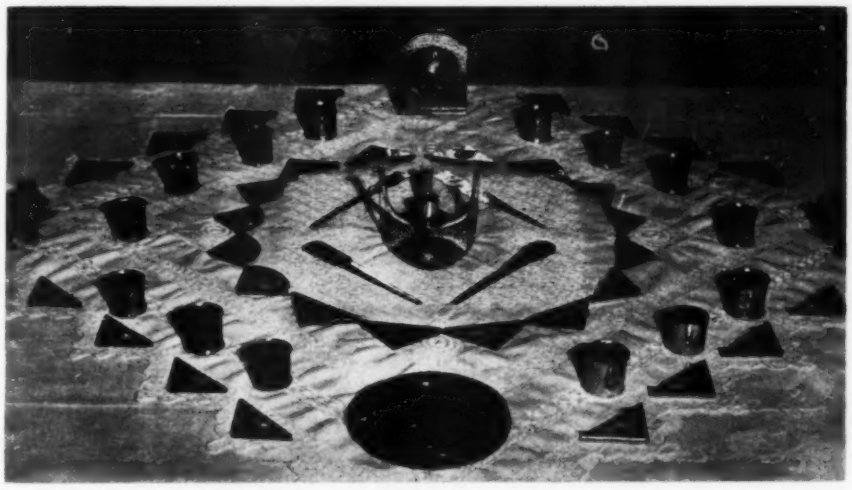
Sheets may be distributed or put on bulletin boards and colored to give them eye appeal and to aid in instruction value.

(To be continued)

RECOGNIZING AND APPLYING DESIGN MOTIFS

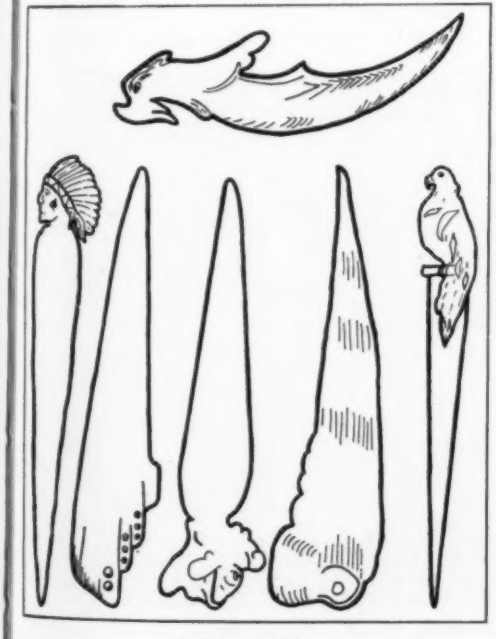
E. L. LONGLEY
University of Maryland
Baltimore, Md.

The industrial-arts student is frequently given so much information that little is left for him to discover for himself. In his shopwork, too, he is asked to transfer exact dimensions to his wood or metal, and is thus given slight chance to think and convert

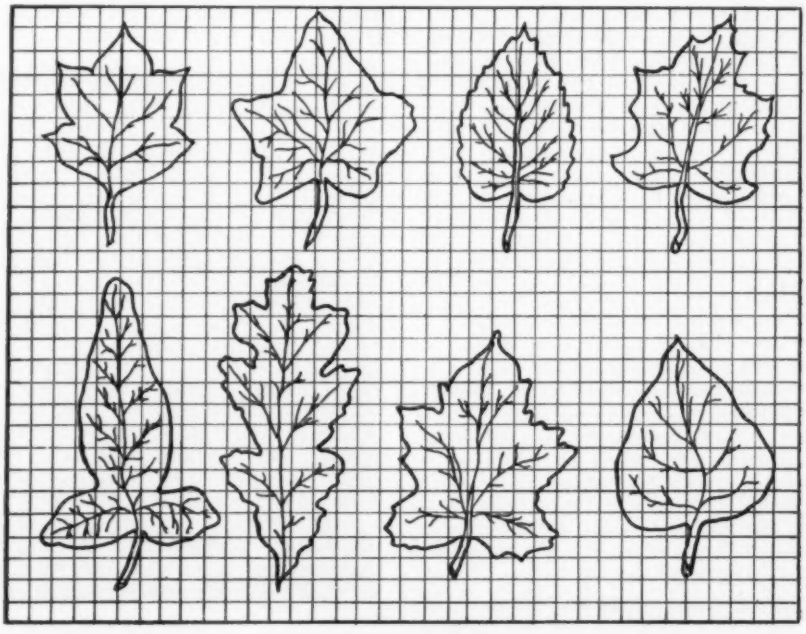


A group of simple projects in art-metal work

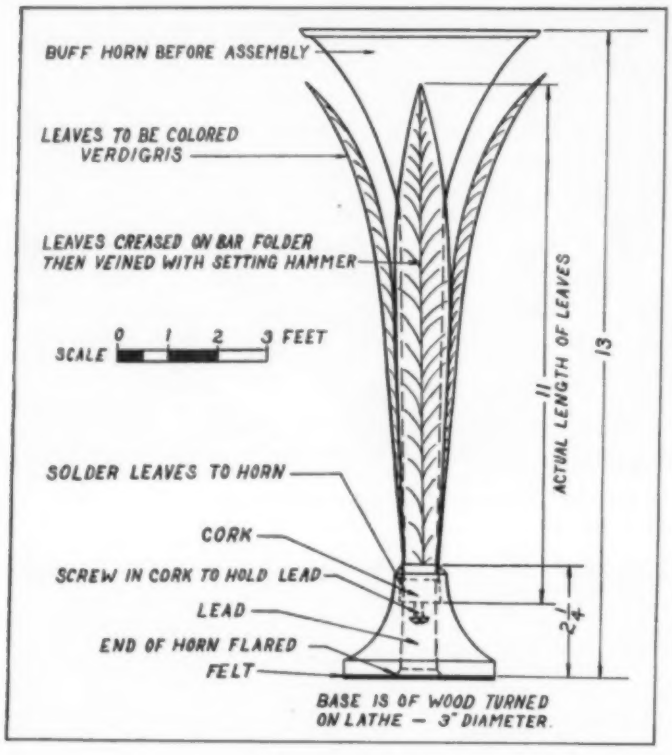
Advanced work in art metal



Letter openers



Leaf motifs



Flower vase

Bood ends

and create. Of course, in certain types of work, this method is necessary. In the machine shop, for instance, the work is of such a nature that it must be carried through in a mechanical way to produce a particular part for a certain machine or device. Engineering work demands this, and in a machine shop we are teaching boys the rudiments of machine work for trade or supplementary knowledge for the engineering field.

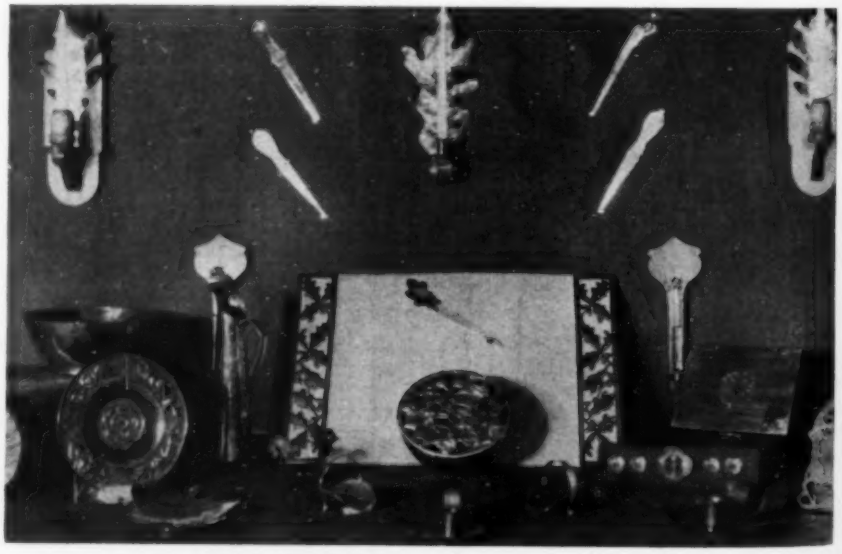
However, in our industrial-arts woodwork, sheet metal, and art metal work, we have fields in which the boys can be trained to plan their own projects. For example, where would a boy look for ideas for a design for a paper knife which he may be making in the art-metal shop? What sources would he go to for the design for a pair of book ends, or a matchbox holder, or a cigarette holder? How would he plan an unusual dinner chime? Where would he get a design for his small lamp he may be about to turn on a lathe? Or where can he find a design suitable for an ash tray, or a candleholder, or sconce?

We seem to forget that nature can give us many suggestions that can be readily adapted. A boy living in a surburban section has a chance to study many trees. Why should he not apply an oak leaf in his design for a neat letter opener? Why should he not use a leaf design when he is making a small tray? While the oak leaf makes a lovely design for the projects mentioned, a modified maple, gum, elm, or other leaf will do just as well. From the fish store or market, one can obtain the shape of a wide but thin fish, such as the flounder or sun fish, and the outline of this may be given to a tray. This may be raised from a piece of 22-ga. copper, brass, or aluminum. The details of the fish can be put in with scratch awl, small chisel, tracing tool, or a motor-driven tool. For some of these sheet-metal projects tin plate also may be used.

This type of project also can be used to teach riveting, sweat soldering, raising, filing, polishing, coloring, and lacquering.

To go back to woodwork, the student who plans to turn up a lamp, or a pair of candlesticks, can get his design from a table leg, post of a four poster bed, or a tall cylindrical vase, columns of buildings, and the like. For flat woodwork, such things as animals in sitting positions, and other objects from life can be sawed out and used.

For designing book ends, there are numerous possibilities. Several examples will be given for this project. A modern design fireplace



From the simple to the complex in art-metal work

Advanced work in art metal

can readily be converted into a fairly simple book end. Wood or metal or a combination of the two may be used in constructing it. The wood or log basket which usually goes with the fireplace, may be scaled down and made in metal, and loaded with cigarettes just before the guests arrive in the evening. The doorway of a building, or an entrance, with simple columns, could easily be converted into book ends in the same way.

Fields, streams, lakes, and mountains also furnish many motifs that may be applied to various designs for industrial-arts projects. Boats and vessels, a statue in the park, or designs reminding one of an Indian camp, or the army, or the navy will find interesting items to be used on clocks, barometers, ring life preservers, propellers, anchors, and the like.

If a student is thus taught to be wide awake, and to think and observe, he will find much of interest in his own surroundings, which he can apply on his projects in his shopwork at school.

MOVABLE DISPLAY

CHARLES H. SCHEINER
Montauk Senior High School
Brooklyn, N. Y.

When the end of a term approaches, and an exhibition of the work is in order, our thoughts turn to space allotments, number and type of projects to be displayed, and methods of display. It is usually a good policy to display at least one project from each student. Because of lack of space, it is sometimes necessary to devise novel methods of display.

The movable display, shown in Figure 1, which is 14 in. in diameter and 30 in. high, not only enables the shop committee to display many projects, but it also draws the attention of all visitors. An old victrola was utilized as a power plant. By means of experiments with the victrola, it was possible to adjust the governor so that the victrola rotates very slowly.

Procedure for construction of display:

1. Lay out a 14-in. circle on a ¾ by 14 by 14-in. piece of wood. Three pieces are needed.
2. Cut out the disks with a coping saw.
3. Obtain a piece of 28-ga. by 30 by 44¾-in. galvanized iron.
4. Form single edges on opposite sides of metal.
5. Shape metal into a cylinder on forming rolls.
6. With a mallet and hand groover form the grooved seam over a mandrel stake.
7. Insert one of the disks into the center of the cylinder and nail it into place.
8. Insert the other two disks at each end and nail them into place.
9. Remove record holder from the victrola and attach it to the barrel.
10. Drill a series of holes and use Parker Kalon screws for fastening it into place.
11. Paint the cylinder with white enamel.
12. Attach projects to the cylinder with copper wire.
13. Place it in position and adjust the victrola to a very slow speed.

Fig. 1. Movable display

READING A RULE OR SCALE

DENHAM R. GRIFFIN
Nichols Junior High School
Mount Vernon, N. Y.

Name .....
Class..... Mark.....

Before you can make any project accurately, you must use a rule to measure the size of the pieces of wood or metal that you are to use. It is, therefore, very important that you know how to read a rule and measure accurately with it. The drawing below shows a 6-in. rule marked off in sixteenths; that is, each inch contains 16 divisions, each worth 1/16th of an inch.

Part I: How far is it from

1. A to B	7. A to H .....
2. A to C	8. A to I .....
3. A to D	9. A to J .....
4. A to E	10. A to K .....
5. A to F	11. A to L .....
6. A to G	12. A to M .....

Part II: Sometimes the end of the rule that you are using may be worn or damaged. If you measured from this end, you would not have the correct measurement. Therefore, you should be able to measure from the first inch (G) to any other place on the rule. So now, how far is

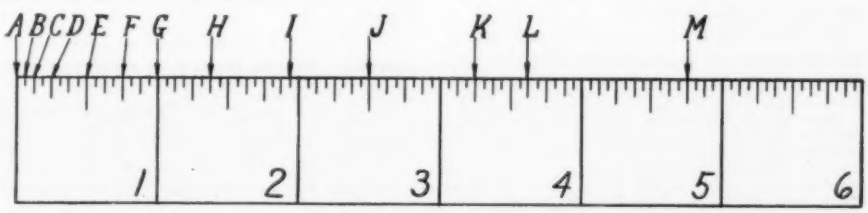
13. G to H	16. G to K .....
14. G to I	17. G to L .....
15. G to J	18. G to M .....

Part III: Now that you can measure accurately from 1 in. to any place on the rule, how far is it from

19. H to I	25. I to L .....
20. I to J	26. J to M .....
21. J to K	27. H to J .....
22. K to L	28. I to K .....
23. L to M	29. J to L .....
24. H to K	30. J to M .....

Part IV: There are times when we need to find one half (½) of some measurement. What is ½ of

31. A to D	34. A to K .....
32. A to G	35. A to L .....
33. A to J	36. A to M .....



Reading a rule or scale

Part V: At a glance you should be able to tell approximately how thick a piece of wood is. The following lines are about the thicknesses of wood you use in the shop. How thick is

37. ..... 38. ..... 39. ..... 40. .....

Part VI: On a piece of paper, draw lines of the following length

41. 2½ in. 43. ⅞ in. 45. 4⅜ in.
42. 1¾ in. 44. 7/16 in.

Part VII: Name five tools that can be used for making measurements

46. .....
47. .....
48. .....
49. .....
50. .....

SAFETY IN THE MACHINE SHOP

LOUIS BAROCCI
High School
Cudahy, Wis.

Many injuries occur in the machine shop. The forepart of this chapter deals with some general precautions to be observed in the machine shop, while the latter part covers safety rules for the operation of the various machines found in this shop.

This safety material for the machine shop was secured through personal contact with a machine-shop instructor and through a review of safety literature found in *Safety Standards and Recommendations for School Shops, Manual of Safety Instruction for Vocational and Industrial Arts* and Safety Instruction Cards.[1]

Some General Precautions

1. Cultivate a mechanic's attitude toward tools, machines, and operations.
2. Long sleeves and long ties are dangerous; they may catch in rapidly moving parts of a machine.
3. Do not wear gloves when working on moving machinery.
4. Remove safety guards only when the nature of the work demands that the guards be removed, and upon the approval of the instructor only.
5. Never operate machines when the instructor is not in the shop.
6. Do not wear rings.
7. Never attempt to stop a machine after the power has been turned off by catching the belt or by applying friction with the hand.
8. Oil machines at regular intervals. Break the main switch when so doing.
9. Check frequently all adjustments of bolts and nuts on all machinery.
10. Keep the floor free of oil and grease. Should grease or oil be dropped on the floor, cover it immediately with sand or sawdust.
11. Keep passageways clear of all obstacles.
12. Hand tools to one another; never throw them.
13. Insist that the shop always be lighted sufficiently and that it be well ventilated.
14. When repairs are being made on machinery, always break the current by removing the fuses or locking the switch.
15. When someone wishes to talk to the operator, shut off the machine at once.
16. Always place scraps and short length material in proper receptacles.
17. Do work on overhead machinery only under the direct supervision of the instructor.
18. Do not operate a machine with a creeping clutch.
19. Never take a chance with a dangerous operation. You may lose.
20. Always have spoke pulleys properly guarded.
21. Never hammer hardened steel surfaces together.
22. When using the hand drill, decrease the pressure and increase the speed when the drill commences to break through.
23. Before using hammer heads see that they are secure.
24. Always store waste and oily rags in a fireproof receptacle.
25. Never permit chisels to become mushroomed; dress them frequently.
26. Never use a file without a handle. Insist on safety handles (the type which will not come off accidentally).
27. Watch your stance when lifting heavy material; lift with your legs, not your back.
28. In tightening vises, use hand power only.
29. When someone is standing in line with the flying material, do not cut off rivets or bolts.
30. Do not use defective tools or equipment. Keep everything in working order.
31. Never use belt fasteners on hand shifted belts.
32. If an overhead belt catches and begins to wind around the shaft, get away. Shut off the power immediately.
33. When replacing a belt, stop the machine and adjust the belt on the driver pulley first.
34. When shifting overhead belts, always use a stick reaching nearly to the floor.
35. Whenever they are in motion, always guard all gear and drive chains.
36. Always wear goggles at shapers and grinders, while welding, chipping, or pouring metal, and when lighting furnaces, even though the operation may take only a moment. Flying chips from cutting tools and sparks from grinding operations have caused many serious injuries.
37. Do not store materials or tools on unguarded overhead trestles or platforms from which they might fall.
38. Before throwing on power, always examine a machine carefully to make sure that every part is in working order. If possible, move the machine by hand before throwing on power.
39. Lock the switch or hang an "Out of Order" sign on a machine that is out of order.
40. Avoid the use of projecting setscrew heads on revolving parts.
41. Have toolroom boy make daily inspections of hand tools to be sure they are safe for use when they are issued.
42. Use only heavy rubber covered cord for all extension cords. Connect extension cords only to wall outlets, never to lighting circuits. Whenever possible, avoid the use of extension cords by arranging for permanent electrical installations.

SAFETY RELATIVE TO THE OPERATION OF VARIOUS MACHINES IN THE MACHINE SHOP

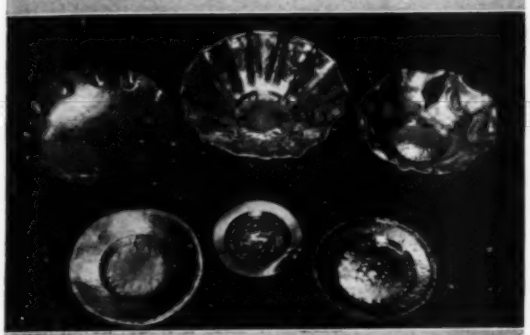
The Lathe

1. A rubber mat carefully laid before the lathe removes the danger of slipping.
2. When you must leave the machine, always turn off the power.
3. Drill center holes of the work sufficiently deep.
4. Wear goggles when the work is such that it throws fine chips.
5. Always screw the chuck firmly against the spindle shoulder, so that, when the lathe is reversed, the chuck will not unscrew and fall off.
6. Always stop the lathe before changing the position of the tool post.
7. Always stop the lathe before backing a tool out of the hole.
8. Never attempt to clean lathe center holes while the machine is running.
9. Never put on or remove a chuck or faceplate when the spindle is being driven by power.
10. Never leave the wrench in the socket after chucking the work.
11. When doing spindle turning, be sure that the tailstock is firmly clamped before turning on power.
12. The safest way to file work on a lathe is with the left hand. This places the body away from the revolving part of the machine.
13. For slender work, especially brass, set the cutting tool on center, never above center.
14. When changing to or from back gears, be sure that the clamp nut is in place and tightened.
15. When the machine is in motion, never oil the lathe nor countershaft.
16. When using either lead screw or friction feed, be sure that the other feed is out.
17. Before taking job from centers or chuck, always stop the lathe.
18. Never handle or play with hot spiral turnings.
19. It is good practice to place a piece of wood under the chuck or faceplate when removing it from the spindle. This may prevent injury both to fingers and lathe.
20. Before turning on the power, be sure that the work is securely fastened in the chuck of the faceplate.
21. When throwing feeds, be very careful to see that the carriage is not locked.

(Continued on page 24A)

[1]John Media, Instructor of Machine Shop, Cudahy High School, Cudahy, Wis.: *Safety Standards and Recommendations for School Shops*, School district of Lancaster, Pa., 1934, pp. 41–70; *Manual of Safety Instruction for Vocational and Industrial Arts*, Santa Ana High School Press, 1937, pp. 21–33; Safety Instruction Cards Nos. 102, 130, 150, 297, 89, 245, National Safety Council, Chicago, Ill.

Dixon Tools helped make this prize-winning entry for students of Battin High School, Elizabeth, N. J., Mr. H. Schopp, Instructor.



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THIS YEAR, for the first time, 8 Special Awards consisting of 3-day, all-expense visits to Detroit and Dearborn have been created for the instructors of students whose work earns a Special Achievement Award in the 1950 Industrial Arts Awards Fair.

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Who Is Eligible? Boys and girls enrolled in the 7th through the 12th grades in any type of school (public, private, parochial). MUST be enrolled in at least one shop or drawing course. THERE IS NO ENTRY FEE.

Entry Classes—The 8 major divisions include wrought metal . . . patternmaking and molding . . . wood working . . . electrical . . . drawing . . . machine shop . . . plastics . . . printing. Nineteen classifications within these divisions, and two to four age groups in each classification.

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SAFETY IN THE MACHINE SHOP

(Continued from page 218)

22. While the machine is running, never throw in the back gear.

23. Keep away from a rapidly running lead screw, especially if it has a longitudinal way.

24. Never "fool around" or touch a running gear.

25. Keep machine clean and in first class order. Be prideful of a well-kept lathe.

26. When throwing in transverse feed, be sure that the carriage lock is not set.

27. Keep the countershaft well oiled to prevent the lathe from starting when the clutch is out.

28. When using either the lead screw or friction feed, be sure the other feed is out.

29. Heavy and rapidly revolving pieces should be carefully balanced.

The Shaper

1. Never inspect the work by standing in line with flying chips.

2. Do not attempt to make any tool adjustments while the machine is in motion.

3. Remove all chips with a brush; do so when the machine is not in motion.

4. Never point to a tool which is in motion. Keep the fingers away from moving parts.

5. Before turning on the power, test the machine setup by hand.

6. Should your work be knocked loose from its setting, immediately shut off the power.

7. A shaper with a creeping clutch should be considered out-of-order and no work permitted thereon until the clutch has been repaired.

8. Do not shift gear levers while the machine is in motion. Replacing gears is expensive.

9. When using a vise, check it carefully before starting the cut to see that it is securely fastened.

10. When an angular job has been finished, always set the head back to zero.

11. When adjusting the head or table of a shaper, the beginner ought to turn off the power. Many a novice has turned the work in front of the tool instead of away from it.

12. Keep the passageways about the machine clear and clean.

13. Always feed on the return stroke.

The Milling Machine

1. Whenever the nature of the work permits, feed the cutter against the work.

2. Before starting to cut, see that the cutter is clamped properly on the arbor and that the work is held securely.

3. Before throwing in automatic feeds, remove all loose handles and cranks.

4. Never attempt to loosen the arbor nut with the use of machine power.

5. Always use a brush to remove chips from a revolving cutter.

6. Never reach across a revolving cutter to attempt to regulate the flow of the cutting solution.

7. Before throwing in automatic feeds, check to see that the automatic stops are set.

8. Before throwing in back gears, always stop the machine.

9. Never leave a machine unattended without releasing all automatic feeds.

10. Never run a cutter at too high a speed.

11. When the machine is in motion, do not use a steel scale, fingers, or waste to remove chips.

12. Keep your eyes and mind on your job.

The Planer

1. Before starting a planer, check carefully to see that the work will clear the cross rail and housing. Also see to it that the platen clears everything at the extreme point of travel.

2. Always feed on the return stroke.

3. Do not ride on planer table.

4. Never reach across the platen of a planer while the machine is in motion.

5. Keep your legs and body clear from shifter lever on the side of the planer.

6. Always place safety dogs at the end of the planer platen to prevent its running off the ways.

(Continued on page 26A)

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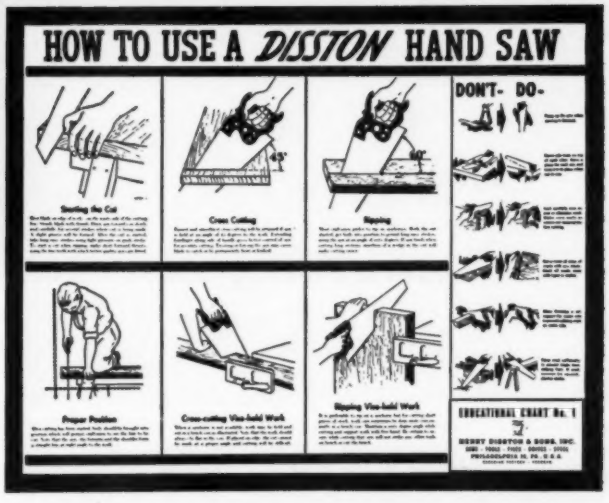

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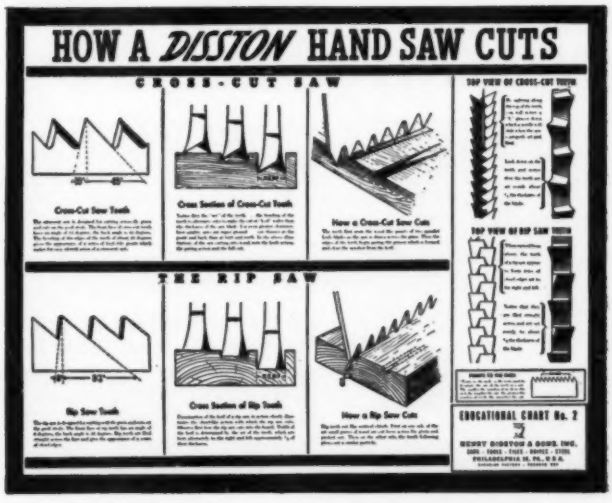

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SAFETY IN THE MACHINE SHOP

(Continued from page 24A)

7. Remove chips with a brush and only when the machine is not in motion.

8. Do not stand in line with the action of the platen.

9. Keep the ways clear of chips.

10. Never shift a dog during the stroke.

11. If the shifter handle cannot be locked when attempting to repair the machine or set up the work, always turn off the power.

12. At no time, under any circumstances, place yourself in a position in which you could be caught between the crossrail, the housing, and the work.

13. At no time, place yourself in such a position that you might be caught between the platen and the bed.

14. Never place tools in the holes in the platen.

15. Never stand in line with flying chips.

16. Never use the platen of the planer for an anvil.

17. When leaving the machine, throw all feeds out, shift belts on idlers or gears into neutral position, and lock the shifter handle.

18. When you have finished an angular job, always set the head back to zero.

19. Obstructions on the passageways of a planer while it is in motion may cause the operator to fall into the machine. Keep the passageways clear.

The Grinder

1. When grinding, always wear goggles or use the safety glass guard. Replace the elastic head bands whenever necessary.

2. Under no conditions must the distance between the tool rest and wheel exceed one-eighth inch; keep the tool rest as close to the wheel as you can. Work which jams between the rest and the wheel may pull the hand into the wheel.

3. It is dangerous to work on an emery wheel which is not guarded with a protection hood. Do not operate any unguarded grinding wheels.

4. Discard all wheels which do not run through and cannot be trued by dressing.

5. Apply work gradually to a cold wheel.

6. Avoid grinding on the side of a light wheel. Do side grinding only on wheels designed and built for side grinding.

7. Use only wheels running through.

8. Never run wheels faster than the speed intended for the wheel. Check this carefully.

9. Keep the path of the wheel travel clear of any obstruction.

10. When starting the grinder, do not stand in line with the wheel.

11. It is dangerous to grind work held with pliers. The work may slip from the pliers and catch between the wheel and the machine rest and cause an accident.

12. Unless you have the diamond-type dresser, use only wheel dressers equipped with guards.

13. Before mounting a new wheel, check the wheel's rating speeds. Never force a grinding wheel on an arbor. Safety flanges of the proper size should be adjusted against felt or rubber-faced washers and should not be clamped too tightly. Loose clamping keeps pieces of the fractured wheel from flying about if the wheel should break.

14. Grinding wheel belts must be run slack.

15. Excessive pressure against the grinding wheel causes overheating and breakage.

The Drill Press

1. Before starting to drill, always remove the key from the chuck.

2. When operating the drill press, be careful regarding loose clothing and long hair.

3. Do not attempt to shift the belt from one pulley to another until the machine has come to a complete stop.

4. Before starting to drill, be sure that material is firmly held in the press vise or clamped to the table.

5. Before starting to drill, center-punch all work.

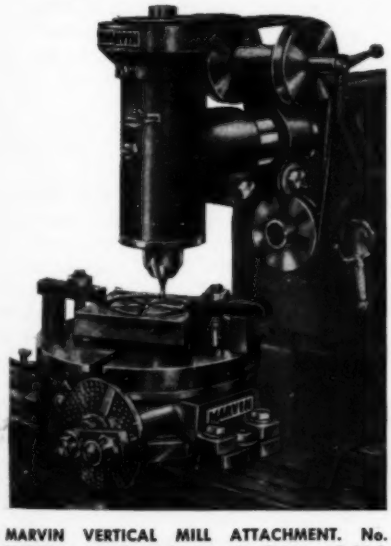
6. Keep the drill cool and sharp by using the proper lubricant for the job.

7. Brush chips away with a brush only. Do not use scale, hands, or rags.

8. Before starting to drill, be sure that the table and head are securely clamped.

(Continued on page 28A)

BROADEN YOUR RANGE OF INSTRUCTION UP TO 500% WITH MARVIN MACHINE TOOL ATTACHMENTS



MARVIN VERTICAL MILL ATTACHMENT. No. V-1200, a Head combining simplicity and high performance with low cost. This Marvin *Head can be set at angles*, pulled out far past the travel of the table for large overhanging work. Simple to attach. Has a heavy spindle equipped with Timken tapered roller bearings which assures smooth operation at high speeds. Spindle nose takes end mills with ⅜" straight shank, up to ½" diameter cutter. Unit is machined to slip over 1½" overarm. Easily adapted to other size overarms. Height 7½". Price $65.00.

You will broaden your range of milling machine instruction 400% to 500% with Marvin precision units. Marvin equipped mills cover the widest possible field of operations (within the capacity of the mill), allow more students, more practical instruction for less investment and less square feet of floor space per machine.

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MARVIN DIVIDING HEAD. No. D-1400. The Marvin Dividing Head provides wide latitude in selecting various divisions to meet specific requirements. The Marvin Head is ideal for dividing operations required in gear cutting, lay out, splines, etc. Complete with 3 index plates, each having 6 sets of holes. It will tilt 5° below horizontal axis to 30° past vertical axis—total 125°. Head is mounted on 2 heavy trunnions. Price $99.50.

MARVIN ROTARY INDEX TABLE. No. 7-1102. A strong rigid precision table at a moderate price.

The 6" table is graduated in degrees and has "T" slots for ⅜" bolts, with a bushing in the center. 3 index plates with 6 sets of holes each give a wide range of divisions. Price $93.00.

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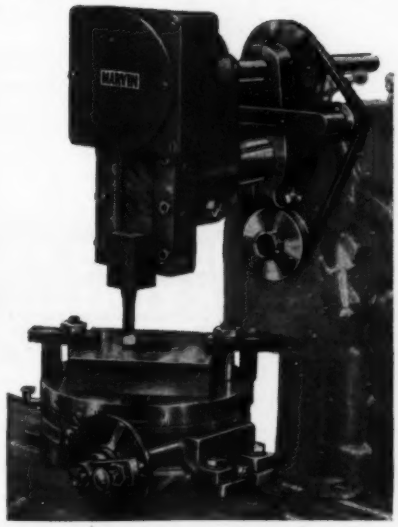

MARVIN SLOTTING ATTACHMENT. No. S-1070. The Marvin Slotter can be quickly mounted. *It can be set at angles to get draft on dies*, etc. Can be pulled out past the travel of the table to handle large overhanging work. The stroke is adjustable from 0" to 2". Holder takes tools having ½" shank, machined to fit 1½" overarm by using a bushing or turning down a special overarm. Height is 7½", width 4½". Machines dies, squared or splined holes, internal gears, etc. Price $82.00.

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MILLERS FALLS TOOLS
SINCE 1868

MILLERS FALLS COMPANY
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SAFETY IN THE MACHINE SHOP

(Continued from page 26A)

9. Never attempt to stop a revolving piece of work. Shut off the power and allow the press to stop.

10. When the drill has entered the work below the flutes, frequently withdraw it and remove chips.

11. When drilling thin material, clamp the material between two pieces of wood; then drill.

12. Do not throw on the automatic feed before the drill is started in the hole.

13. Always remove the chuck and taper shank drill with a drift. Catch it as it drops out.

14. When the drill is breaking through the work, feed slowly.

15. When a drill slips in a chuck, do not attempt to tighten it until the spindle has come to a stop.

16. Never strike a drill, chuck, or socket with a hammer. Use a piece of wood or a lead hammer.

17. While the power is on, never throw in the lock gears.

18. When drilling large holes, always clamp the work securely to the table and use stops to prevent the work's tearing loose and causing injury.

19. In operating the drill press, do not lean over so far that hair or clothing may be caught in the revolving spindle or belt.

From the large number of machine shop safety rules just cited, whether general rules or rules affecting certain machines and certain operations, it can be seen that the accident possibilities in this shop are numerous. Such matters as the proper clothing, the proper tools, the range and limitations of the work that can be done on the lathe, the shaper, the milling machine, the planer, the grinder, and the drill press, must be carefully observed and followed if accidents in this shop are to be avoided.

FROM L. H. DENNIS' AVA WASHINGTON LETTER

George-Barden Appropriations for 1950–51 — Urgent. The bureau of the Budget recommended to Congress that the George-Barden vocational education appropriations for 1950-51 be in the amount of $23,435,000. This sum was considered by the House Subcommittee on appropriations when they held their hearings with Commissioner McGrath and members of the U. S. Office of Education staff. It was evident in the hearings that the economy wave in Congress is gaining momentum, and each day the pressure for economy and reduction of appropriations becomes more acute. The Subcommittee finished its consideration of appropriations and its recommendations have been acted upon by the full Appropriations Committee. The full Committee has recommended the same amount for next year as for this year, with no increase.

We are giving you the above information in order that you may know the situation as of now. You should be aware of the fact that strong representations are being made to your Senators and Congressmen asking them to reduce appropriations. If your Senators and Congressmen finally grant the $23,435,000 for George-Barden appropriations to the states for next year, it will be because your vocational education leaders in the states have given them a sufficient demonstration of the fact that these appropriations are badly needed and are genuinely wanted in the states. The matter is now in your hands. How well and how thoroughly you inform your Senators and Congressmen may give the answer.

Association News

♦ The Northeastern Ohio Industrial Arts Association held its spring meeting on April 15, 1950, at Canton, Ohio.

Visits were made to the Timken High School, North Market Street, and to the Timken Roller-bearing Company.

Merle E. Leggett presided at the luncheon meeting. Harold S. Vincent, superintendent, Canton city schools, addressed the visitors. The business meeting followed.

Demonstrations on metal spinning, transveneering, and alloy soldering were given at McKinley High School.

♦ The plans of the 1950 Annual Michigan Industrial Education Society convention are prac-

(Continued on page 31A)

FRANKLIN GLUE IS READY TO USE WHEN CLASSES START

Industrial Arts Teachers from coast to coast recommend

FRANKLIN Liquid HIDE GLUE

the ideal for class use

Here is a *genuine hide glue* that's ready to use without mixing, heating, muss or waste. Full strength, actually makes joints stronger than the wood itself. Tests prove from 4000 pounds to 5000 pounds per square inch with resulting 100% wood failure.

Franklin Liquid Hide Glue is used by best furniture factories and fine craftsmen. It's pleasant, no odor, and spreads thin to make almost invisible joints.

Costs less because there is no waste, unused portions can be poured back in can.

Ideal for school use: eliminates fire hazards, genuine hide glue recognized for years as craftsman's glue, no danger of chilled joints, spreads smooth, even, easy.

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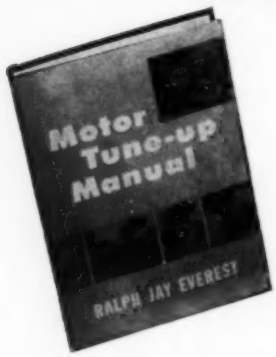

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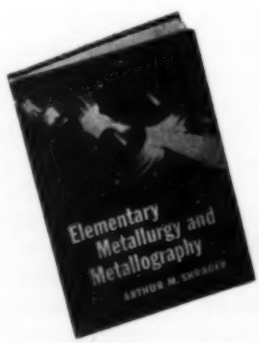
By Ralph J. Everest

Exceptionally full, clear explanations of auto electricity and of engine and combustion principles give the student the knowledge he needs in order to make the right analysis of engine trouble as well as to make corrective adjustments accurately and skillfully. All engine parts are clearly explained. Detailed instructions are given for every step in both minor and major tune-up jobs. "A very fine text," says the Dir. of Vocational Education in Lockport, N. Y. "Very clearly written and well illustrated." $5.50



ELEMENTARY METALLURGY AND METALLOGRAPHY

By Arthur M. Shrager

The first text on this important basic science for vocational school students, already being highly recommended by the metals trade because "it affords ample opportunity to gain a useful working knowledge and understanding of the subject . . . clear, concise, and easy to follow." (Stuart Kingsley, in *Journal of the Franklin Institute*). This book now supplies the teaching materials you need for the related science course on metals for students of foundry, welding, and the other metal-working subjects." $4.75

Write to our Educational Department for sample copies to consider for your courses next term.

ASSOCIATION NEWS

(Continued from page 28A)

tically completed, according to the officers of that organization. The convention will be held at Grand Rapids, April 20, 21, and 22, at the Civic Auditorium.

"Equal Opportunities for all Michigan Youth" is the convention theme, and all efforts are being expended to improve the industrial-arts courses given in the state.

The officers who are planning this year's convention are: Roland R. Fraser, president; Joel Lee, past president; Chas. Kemp, vice-president; Maurice C. Overholt, secretary-treasurer; Walter Scharmack, exhibit manager; J. Herbert Cigard, parliamentarian; and Harold Van Westrienen, ex-officio.

♦ The Ohio Industrial Arts Teacher Education Conference will be held on April 21 and 22, 1950, at Bowling Green State University, Bowling Green, Ohio.

R. M. Torgerson of Bowling Green State University is the general conference chairman.

The conference will start with a shop visitation at 1:00 p.m., Friday, April 21.

At 3:30 there will be a report on the status of state supervision, and a study of the district industrial-arts associations in Ohio. The visitation and follow-up of teachers also will be discussed.

D. J. Crowley will preside at the banquet at 6:30 p.m., and D. Arthur Bricker will speak on the annual meeting of the American Industrial Arts Association to be held in Cincinnati, Ohio, at the Netherlands Plaza Hotel on May 11, 12, and 13.

On Saturday morning the discussion will center on significant changes that have been or will be made in the industrial-arts curriculum.

The supply and demand of industrial-arts teachers for Ohio for the school year 1950–51, will be discussed by P. S. Waldeck, Ohio state supervisor of industrial arts, and H. M. Jellison, and E. J. Robinson will present the viewpoint of city supervisors on this subject.

♦ The Fourth Annual Industrial Arts Spring Conference at the Buffalo State Teachers College will be held on Tuesday and Wednesday, May 2 and 3.

Dr. John T. Furbay, nationally known speaker and authority on air education, will deliver the opening address on Tuesday at 10:00 a.m.

Other speakers of prominence include Dr. Louis Rosensweig, supervisor of education of the handicapped at Brooklyn College who will give an enlightening talk on handicapped children in industrial arts; also Dr. John Thomson, professor of industrial arts at New York University, who will give an address on crafts in the industrial-arts program.

A panel on crafts and problems in the industrial arts will follow.

Interesting exhibits of projects which are incentives for any motivation and appealing to all will be displayed by several western New York high schools.

Demonstrations and exhibits by a large number of commercial manufacturers will add further appeal and zest for all who are interested in education. — *Richard J. Parker,* Publicity Chairman.

♦ The Twelfth Annual Industrial Arts Conference will be held at the Oswego State Teachers College on May 4 and 5. Dr. Harold Sylvius, chairman of the Department of Industrial Education at Wayne University in Detroit, will be one of the speakers.

Gordon O. Wilber, head of the Industrial Arts Division at Oswego, will give an illustrated lecture entitled "Ten Thousand Miles of Industrial Arts." This lecture will include many kodachrome slides which Dr. Wilber took on his recent tour of the industrial-arts centers throughout the United States.

The program will open on Thursday, May 4, at 10:00 a.m. with Dr. Wilber's lecture, followed by a general discussion session. Thursday evening will feature the annual Epsilon Pi Tau banquet with Dr. Sylvius speaking on the subject "The Industrial Arts Teacher and His Profession."

The Friday program will be composed of an Epsilon Pi Tau Breakfast at 8:00 a.m., followed by a general session at 10:00 a.m., with Dr. Sylvius speaking on the subject "Industrial Arts in 1950 — Status and Trends."

♦ The 25th annual meeting of the American Association for Adult Education will be held at the Hotel Hollenden, Cleveland, Ohio, on May 4, 5, and 6.

The questions to be studied and discussed are "What Adult Educators Can Do to Develop Greater and More Effective Participation in Public affairs," and "How Adult Educators Can Develop a Single, More Effective National Organization."

♦ The Annual Industrial Arts Conference will be held at the Millersville State Teachers College on May 5 and 6. Friday afternoon will be spent in visiting the commercial exhibits, and at the dinner meeting there will be an illustrated address on "Modern Shops and Shop Planning" by Professor William Huss, Oswego State Teachers College.

Saturday morning will be devoted to demonstrations and exhibits of work from adult education groups, craftsmen, and college students.

Professor Lowell Monical, State Teachers College, Millersville, Pa., and William Hartman, senior industrial-arts student at Millersville, will give a television broadcast on "Working with Plastics." This will be followed by a contest sponsored by the Industrial Arts Society for junior high school boys. There will be sailboat regatta, plane flying, kite flying, and photography.

(Continued on next page)

ONLY BOICE-CRANE MAKES THIS POPULAR "COMPLETE WORKSHOP" WHICH INCLUDES A TILTING ARBOR SAW

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Imitations have saws on which the TABLE not the BLADE tilts. Unique drive permits mounting motor rigidly and separate from machine.

This "complete workshop," especially practical where space is at a premium, rips, cuts, mitres, planes, rabbets and grooves. Longer table and fence guarantees perfect work on longer stock. The 6-inch jointer planes and rabbets ½" deep. The 10-inch saw table has extra capacity built in. You can square off work up to 13 inches wide in front of the blade without costly additional front extensions.

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Here is the only 10-inch tilting arbor saw which can be driven by low-cost standard motors, gas engine or line shaft by using rolling drive pulley. Motor is entirely separate from machine and away from dust, keeping vibration from the arbor, eliminating needless wear on trunnions and slideways. Stays accurately locked in any tilted position. The 28-inch cast iron rip fence is *precision ground* on *both* sides. Lightning fast automatic control of both front and rear locks.

Approved safety guard hood shields entire saw blade, tilts with blade. Ribbed steel splitter prevents work binding. Anti-kickback feature.

Table: 20" x 27". Saw blades: 10" dia. max. Dado Heads: 6" dia. x 1-1/16" wide.

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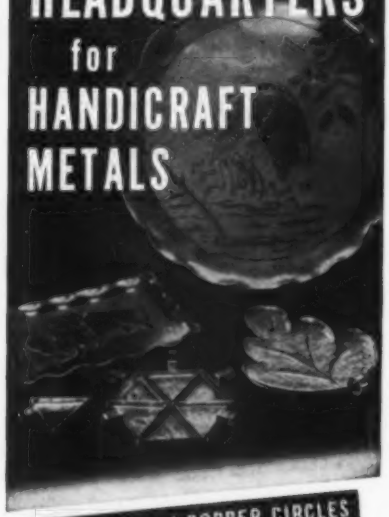

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ASSOCIATION NEWS

(Continued from previous page)

Dr. John Ludington, specialist in industrial arts, U. S. Office of Education, is scheduled to give an address at the luncheon meeting, which will close the conference.

♦ The American Vocational Association recently appointed a committee on Automobile Mechanics Instruction to work with the Automobile Manufacturers Association in preparing recommendations for the improvement of automobile mechanics instruction, generally.

The conference recently published a booklet entitled "Automotive Instruction in Your Community." This is a 15-page, 8½ by 11-in. booklet and is available free from the Automobile Manufacturers Association, New Center Building, Detroit 2, Mich. Eighty-five thousand copies of this booklet have already been distributed and a new printing is now in process. This will be the last printing.

♦ The Industrial Education Association at the University of Maryland sponsored an open house at College Park on March 17, 1950, between the hours of 9:00 a.m. and 10:30 p.m.

Some of the activities featured were the following:

1. Cabinetmaking demonstrations involving special machine setups.
2. Demonstrations of the coloring of metals by heat and chemical means.
3. Spinning, forming, and shaping of metals.
4. Demonstrations of various machine operations in the machine-shop area.
5. A demonstration of the making of sand molds and the pouring of castings from molten aluminum.
6. An opportunity to observe the processes of gas and arc welding.
7. A demonstration of silk screening and linoleum block printing.
8. Internal carving of plastics and leatherwork.
9. Visual aids and related materials were shown, and their uses and values were discussed.

Meeting

At 7:30 p.m. an open meeting jointly sponsored by the Industrial Education Association and the Iota Lambda Sigma professional fraternity was held. The guest speaker was Dr. Thomas G. Pullen, Jr., superintendent of schools of the state of Maryland.

♦ The Annual Convention of the Ohio Industrial Arts Association was held at the Deshler-Wallick Hotel, Columbus, Ohio, on February 23, 24, and 25. Six hundred and fifty-one teachers, supervisors, and school administrators attended the two and one-half days' conference.

At the Thursday afternoon session, Frank Moore, director of industrial arts, and president of the A.V.A., presided.

The speakers were Otis C. Hatton, superintendent of schools, Akron, Ohio, and Mrs. Norma C. Wulff, president, Cleveland Board of Education. They discussed industrial arts from the viewpoint of the administrator and of the board president, respectively.

The annual dinner at 6:30 p.m. was presided over by Phil Waldeck, supervisor of industrial arts, Columbus, Ohio.

On this occasion, George H. Fern, assistant director, Education Department, National Association of Manufacturers, New York, gave an interesting talk on the coming industrial-arts awards contest for junior and senior high school students which the Ford Motor Co., has announced.

On Friday morning D. Arthur Bricker, supervisor, industrial-arts education, board of education, Cincinnati, Ohio, and secretary-treasurer of the American Industrial Arts Association, presided.

The speaker was George H. Fern, who spoke on "The Industrial Arts Teacher in Today's School Program."

The craftsmen's fair which followed, was pre-

(Continued on next page)

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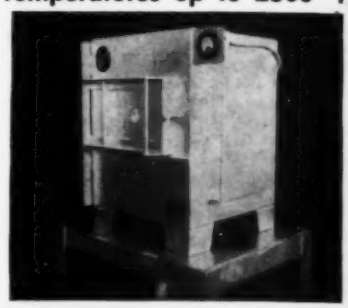
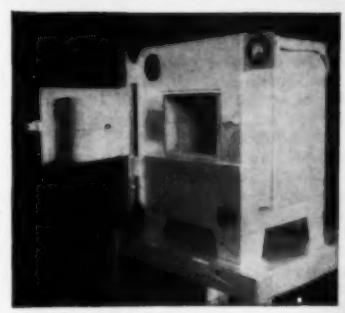
Temperatures up to 2500° F.





Model SK-999 with hinged door and indicating pyrometer.

● Studio Ceramists who desire to explore the high temperature field of Ceramics will want a Harper Electric Kiln, such as the small model pictured above. Stoneware, china and porcelain which have greater strength and vitrification, and crazefree glazes of subtle colors and true brilliance can be fired to perfection in these kilns.

Harper Studio Kilns are especially ideal for the studio potter because they perform dependably and are built to give long service with a minimum of maintenance. Clean uniform electric heat and fine temperature control insure evenly fired ware with few rejects due to firing.

Write to our Kiln Department for recommendations and literature on a Harper Studio Kiln to meet your exact requirements.

HARPER ELECTRIC FURNACE CORPORATION
1445 Buffalo Avenue
NIAGARA FALLS, NEW YORK

ASSOCIATION NEWS

(Continued from previous page)

sided over by Ernest Stotler, director of practical arts, Akron Public Schools, Akron, Ohio.

Demonstrations were given by Henry J. Kauffman, Marshall L. Byrn, Nick Ribich, George Bilsey, and Don Fogarty.

On Friday afternoon, Harry E. Wood spoke on "Simplified Design for Industrial Arts Projects."

Dewey F. Barich, president, Ohio Industrial Arts Association, presided at the annual business meeting held on Friday at 4:00 p.m.

The officers elected for the coming year are: *Merle E. Leggett,* supervisor of industrial arts, Medina County, Ohio — president; *Professor Menzo Stark,* Wilmington College, Wilmington, Ohio — vice-president; *Dwight Spayth,* Bluffton High School, Bluffton, Ohio — secretary; *Professor Theodore Paige,* Ohio University, Athens, Ohio — treasurer; *Richard O. Knight,* Director, Department of Industrial Education, Columbus, Ohio — city representative; *Harold J. Sauer,* Deer Park School, Deer Park, Ohio — exempted village representative; *D. C. Eaton,* High School, Swanton, Ohio — county representative; *Dean Kittle,* Ohio Northern University, Ada, Ohio — industrial arts teacher education representative.

Dewey F. Barich also was chairman at the dinner on Friday evening.

The speaker on this occasion was Dr. Kenneth McFarland, who, in his own inimitable way spoke on "The U in Education."

Saturday morning was devoted to more demonstrations in graphic arts, ceramics, art metal, and electricity.

The Ship's program ended a very successful convention in an entertaining and pleasing way.

MIAMI, FLORIDA, 1950 AVA CONVENTION

The relative merits and comparative facilities of Miami and Miami Beach were discussed by President Frank C. Moore, Charles W. Sylvester, and the executive secretary. The unanimous decision of the three officers was to hold the convention in Miami, as originally planned.

Personal News

♦ Dr. Robert E. Smith, who is retiring from the faculty of Ohio State University after 38 years' service, has been appointed visiting professor at Southern Illinois University for the summer term.

He will teach two courses. One will be a seminar in industrial education which will be open to administrators who are confronted with special problems, as well as to all persons interested in industrial education.

The other course will deal with "Problems of the Co-ordinator."

Dr. Smith, a native of Ireland, began his industrial experience as an apprentice in pattern-making for a manufacturing company, spending four years at this work. He then served as a patternmaker in job shops for five years before going to Ohio State as an instructor in pattern-making in 1912. He attained the rank of full professor in 1940.

He obtained three degrees from Ohio State — the bachelor of science in education, the master of science in psychology and industrial education,

(Continued on page 35A)

Kester Solder

Flame Soldering with Kester "Nosput" flux-core solder. One of Kester's specialized industrial solders that does this job better than any other solder.

No Waste

"Nosput" flux-core solder is only one member of Kester's famous group of flux-core solders. In all there are over 100,000 different types and sizes.

Efficient

Classroom efficiency is improved by teaching with Kester Solders. Kester can supply the right solder for the job, virtually eliminating waste.

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and these NEW Books are our BEST!

They are in keeping with the high RIDER standards. They're "tops" in the field . . . containing more factual information, more practical data . . . more clearly presented than anywhere else.

NOW AVAILABLE!

RADIO OPERATOR'S LICENSE Q AND A MANUAL
by Milton Kaufman

This book is a most complete and comprehensive treatment of the subject and should prove especially valuable as a quick review of essential theory, as well as a refresher for advancement in the field. It lists all the QUESTIONS and ANSWERS for the FCC examinations. However, the outstanding feature of this volume is its thorough FOLLOW-THROUGH . . . a carefully simplified discussion of the answer to the technical question . . . so necessary for a complete and absolute understanding of the answer. Useful appendices, which include Small Vessel Direction Finders and Automatic Alarm, not ordinarily available in a book of this type, provide a valuable "extra."
608 pages. 193 explanatory diagrams.....$6.00

FM TRANSMISSION AND RECEPTION
by John F. Rider and Seymour D. Uslan
Up-to-date • Basic • Complete

For the student who is grooming himself for activity in the electronic field. This book covers the subject of frequency modulation thoroughly in a down-to-earth treatment of all types of FM systems employed in television, radio, amateur radio, railroad, aviation, marine, police, point-to-point and mobile receivers. Basic theory, transmission, reception, circuit design and servicing are covered, with mathematics kept to an absolute minimum. Almost all presently used commercial FM transmitters are described in detail. Question section follows each chapter. Confidential instructor's answer booklet.
416 pages, profusely illustrated.....$3.60

INSIDE THE VACUUM TUBE by John F. Rider

No other book explains so simply and clearly the theory of the vacuum tube and its operation. In plain language — with fascinating pictures and diagrams that really tell a story — you get a solid grounding in theory and a good working knowledge of basic tube types. It's concise, it's accurate.
424 pages, profusely illustrated.....$4.50

UNDERSTANDING VECTORS AND PHASE IN RADIO
by John F. Rider and Seymour D. Uslan
A Shorthand Method to Easier Understanding of Radio Theory

Written for the student and for any man learning, in radio and electronics, who has not had the advantage of previous extensive mathematical education. Step by step, the subject is developed, until finally its application to everyday radio problems is demonstrated.
160 pages, amply illustrated.....Cloth cover, $1.89; Paper cover 99¢

NEW...COMING SOON!

THE THEORY AND PRACTICE OF 30-1000 MC RECEIVING ANTENNAS by Arnold B. Bailey

This book is a rare combination of theory and practice that: 1) Clearly explains and teaches. 2) Can be used as a daily work reference.
An outstanding book, the like of which has never before been written. And since the author has resolved the mathematics of antenna problems into graphs, charts and tables — it can be put to good use by all. Reflecting world-wide knowledge of the antenna art, it clearly explains the theory behind the performance of every type of 30-1000Mc receiving antenna on the commercial market, leaving the reader with a full understanding of why each behaves as it does. Practical in every sense of the word.
More than 500 pages, 6" x 9", cloth bound.....$4.50

The New CATHODE-RAY TUBE AT WORK by RIDER et al

The greatest and most complete reference book ever written on the cathode-ray tube! It is a practical, down-to-earth encyclopedia about five times the size of the old standard text. Starting with basic theory of cathode-ray tube operation, it proceeds through application in scopes and TV receivers . . . with full and clear explanations for uses in every field and research activity which employs a cathode-ray oscillograph. All scopes produced and sold during the last 10 years, more than 70 different models are described completely — with schematic wiring diagrams. Almost 500,000 words and about 3,000 illustrations are incorporated in more than 900 pages. It is a book which will enjoy years and years of daily use. 22 chapters.
8½ x 11 inches.....$9.00

TELEVISION INSTALLATION TECHNIQUES
by Samuel L. Marshall

This book, written by Mr. Marshall, television instructor at the George Westinghouse Vocational High School, is a practical, easy-to-understand treatment of information pertaining to the antennas, transmission lines, receiver adjustments, and above all, the mechanical requirements, whether they be for short mast for chimney attachment or for the installation of a tower, including foundation. Both theoretical and practical aspects of every phase of this activity, from the topmost element of the antenna to the ground connection on the receiver terminal board, are fully discussed.

VACUUM-TUBE VOLTMETERS by John F. Rider
New • Revised • Enlarged

Now completely revised, enlarged, and thoroughly up-to-date, this volume explains theory and functions of the different types of vacuum-tube voltmeters. A special section is devoted to d-c and r-f probes and the concluding chapter discusses the latest commercial types of vacuum-tube voltmeters, complete with schematic diagrams.

JOHN F. RIDER PUBLISHER, INC.
480 Canal Street, New York 13, N. Y.

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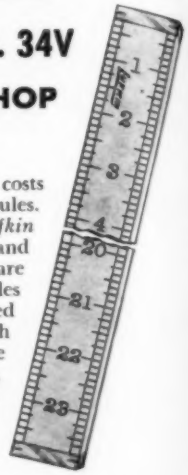
Cut Costs with No. 34V

LUFKIN SCHOOL SHOP WOOD RULES



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Older Johnson Furnaces factory re-built at low cost. Write for details.

JOHNSON GAS APPLIANCE CO.
585 E Avenue N.W. Cedar Rapids, Iowa **FREE CATALOG**

PERSONAL NEWS

(Continued from page 33A)

and the doctor of philosophy in psychology, industrial education, and school administration.

He is a member of Phi Delta Kappa, Kappa Phi Kappa, Epsilon Pi Tau, the Ohio Education Association, the Ohio Industrial Arts Association, the Ohio Vocational Association and the American Vocational Association.

♦ DR. HAROLD J. DILLON, former executive director of the Pennsylvania Public Education and Child Labor Association, has joined Junior Achievement, Inc., New York, as National Educational Director.

Dr. Dillon, a graduate of Boston University, received his Ph.D. at Yale. He was a specialist in Educational Problems for the National Child Labor Committee, and prior to that, supervisor in the Division of Secondary Education of the Bureau of Youth Services, Connecticut State School Department of Education.

He has been a lecturer in education at Michigan State College and New York University and is the author of several books.

♦ A $2,500 extension on a previous research grant was made to DR. AUGUST J. DURELLI of Illinois Institute of Technology for a study of brittle material in stress analysis by the Research Corporation, New York.

♦ K. N. SATYENDRA, 25, has been named instructor in electrical engineering at Illinois Institute of Technology.

He is a native of Mysore, India, and received his bachelor's degree in physics from the University of Mysore in 1943. He was awarded a bachelor's degree in electrical engineering in 1946 and his master's degree in 1949 at Illinois Tech.

His professional associations include membership in the American Institute of Electrical Engineers, the Institution of Electrical Engineers (London), Illuminating Engineering Society, Sigma Xi, and Eta Kappa Nu. He is ex-president of the Hindustan Students' Association of America.

♦ GEORGE F. GEBHARDT, 76, former director of the department of mechanical engineering at Illinois Institute of Technology, died on March 22, 1950, at his home in Miami, Fla.

Mr. Gebhardt was a member of the faculty of Armour Institute of Technology (now Illinois Tech) from 1898 until his retirement in 1934.

He is author of two books, "Combustion" (1925), and "Steam Power Plant Engineering" (1927).

He earned his M.S. degree at Knox college, Galesburg, Ill., in 1897, and in the same year received a master's degree in engineering at Cornell University.

♦ THOMAS L. COATNEY was appointed general sales manager in charge of all sales operations of The Frederick Post Company, Chicago, Ill., on January 25, 1950.

He served as general manager of that company's southwestern division, with offices in Houston, Tex.

Before joining the Post Company in 1939, Mr. Coatney opened and managed The Rush Company (architects', engineers', and artists' supplies), Dallas, Tex.; and from 1930 to 1936 did sales work and assisted in the management of the M. H. West Company (engineering materials) also in Dallas.

Succeeding Mr. Coatney as manager of the Post Company's southwestern division is Arthur C. Morales, former assistant manager.

♦ DR. JOHN M. STALNAKER, co-ordinator of psychological studies and services at Illinois Institute of Technology, has been appointed to the scientific advisory board of the Chief of Staff, United States Air Forces.

The board is composed of forty distinguished scientists, each one an authority in his field. Dr. Stalnaker will work with the air forces on a new panel for social sciences.

He has taught at Purdue, Princeton, and the University of Chicago. He has been special assistant to the president of Purdue, examiner at the University of Chicago, and an official of the College Entrance Examination Board.

♦ ARTHUR DAVIS DEAN, 77, well-known in the industrial education field, died on November 19, 1949, at Danbury Hospital, Danbury, Conn.

♦ BERT BOETCHER has accepted a position as teacher of industrial education at the Boys School in Waukesha, Wis. He began teaching on February 13.

♦ GEORGE V. RADCLIFFE, who received his master's degree from Texas A. & M. College last spring, is now instructor of woodworking at Memphis State College, Memphis, Tenn.

♦ The following students at the The Stout Institute, Menomonie, Wis., completed the requirements for the bachelor of science degree in January, 1950. Candidates with majors in industrial education are:

Fred Amthor, Charles W. Ayers, Robert Babick, Robert Bachmann, Harvey Berghuis, Robert Blaesing, Bert Boetcher, Milton Bolt, Donald Braun, Louis Burmeister, Robert Crowley, Sherman Dreyer, Richard Dunne, Edwin Ebert, William Fehrenbach, Lloyd R. Gannegan, Gerald Gappa, Robert Hanna, Robert Hannes, John E. Hansen, William Hehli, George Jensen, Ellsworth Kane, Joseph Katalinich, Roland Kickbush, Paul Kunz, John Lake, Robert McKay, Thorwald Magnuson, Herbert Meisner, Howard Michalsen, Merlin Moore, George Norton, Arthur J. Oettmeier, Harris Olson, Arnold Potthast, Donald H. Raether, Warren Richter, Lynn Robinson, Richard Roepke, Manford Rotnem, John P. Rudow, Alvin Schmidt, August Schwellenbach, Darwin C. Serra, Ralph Smith, Teppen Thompson, Walter J. Vernon, Gordon Wasinger, Fred Wentorf, Robert A. Willink, Paul Yadlosky, James R. Young, and William F. Young.

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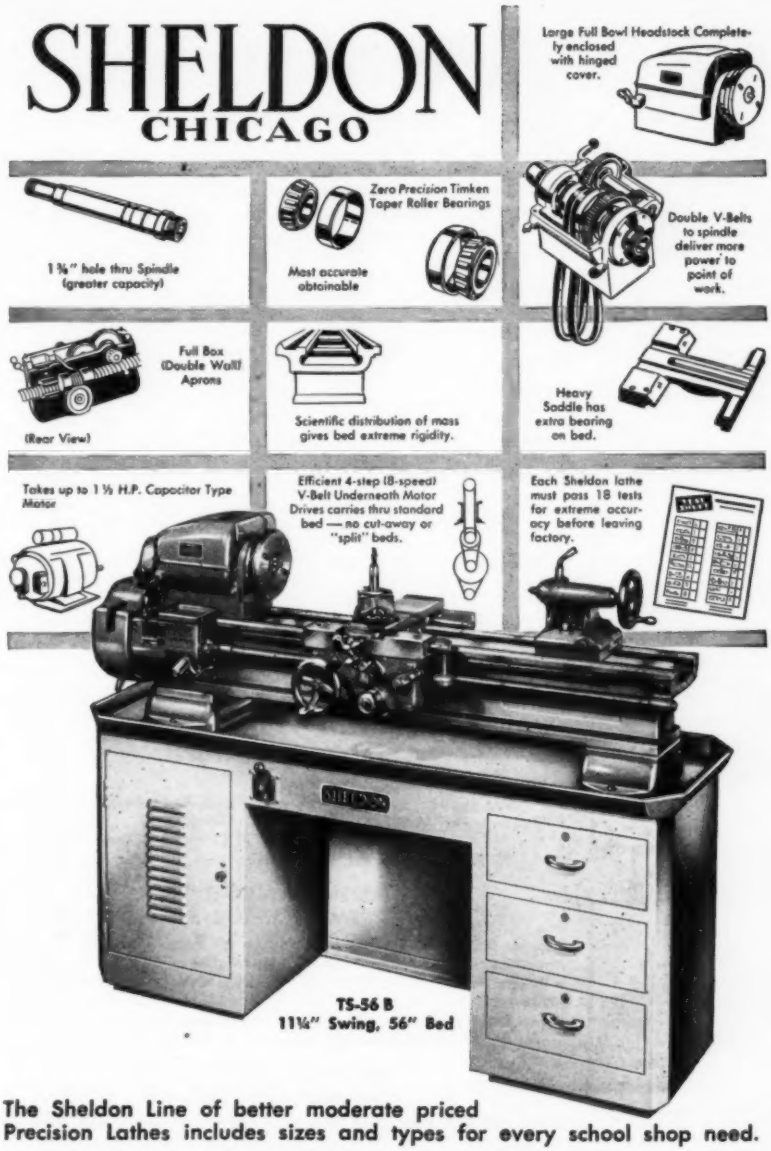
Large Full Bowl Headstock Completely enclosed with hinged cover.
1 ¾" hole thru Spindle (greater capacity)
Zero Precision Timken Taper Roller Bearings
Most accurate obtainable
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Scientific distribution of mass gives bed extreme rigidity.
Heavy Saddle has extra bearing on bed.
Takes up to 1 ½ H.P. Capacitor Type Motor
Efficient 4-step (8-speed) V-Belt Underneath Motor Drives carries thru standard bed — no cut-away or "split" beds.
Each Sheldon lathe must pass 18 tests for extreme accuracy before leaving factory.
TS-56 B
11¼" Swing, 56" Bed

The Sheldon Line of better moderate priced Precision Lathes includes sizes and types for every school shop need.

Write for Catalog. State size of lathe and floor space requirements.

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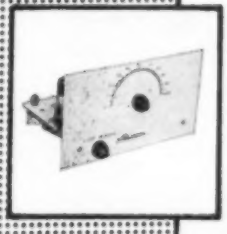
RADIO KITS

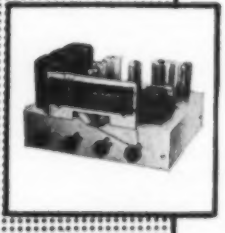
*Painstaking design by skilled MEISSNER engineers has resulted in a line of advanced radio kits of unequalled instructional value. MEISSNER kits incorporate the latest circuits and most modern tubes — assuring highest efficiency and TOP PERFORMANCE! Not "sweep-ups" or factory surplus, each part in a MEISSNER kit is the EXACT AND BEST PART for the job. All MEISSNER kits come with detailed pictorial and schematic diagrams.



MEISSNER MODEL T2BK 2-TUBE BATTERY TRAINER KIT

- High Performance
- Low Drain Battery Tubes
- Powerful Pentode Audio
- Regenerative Circuit
- Tubes & BC Coil Included
- Additional Coils Available

Model T2BK 2-Tube Battery Trainer Kit, Less Batteries, Headphones, Wire & Solder, Net.....$7.35



MEISSNER MODEL T3BK AC-DC TRAINER KIT

- "Beam-Power" Audio Stage
- Range — 175 Kc to 34 Mc
- 3 Tubes & BC Coil Included
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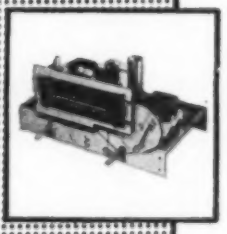
Model T3BK AC-DC Trainer Kit, Less Headphones, Wire & Solder, Net.....$8.98



MEISSNER MODEL T6BK 3 BAND AC KIT

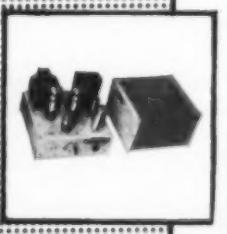
Practical, up-to-date instruction in the latest receiver technique. Detailed pictorial diagram and schematic easy to understand.

ALL STAR FEATURES!

A new, Husky, superb-fidelity amplifier.

- 6 Tubes included with kit
- "Beam-Power" Amplifier
- 535 Kc to 18 Mc in 3 overlapping bands
- Continuous Tone Control

Model T6BK 3 Band AC Kit, less speaker, wire & solder, Net Price...$32.85

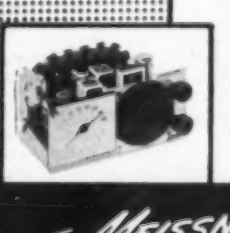


MEISSNER MODEL T8CK FM RECEPTOR KIT

Popular MEISSNER FM Receptor now in kit form. Converts AM receiver to static-free, high fidelity Frequency Modulation.

- Covers New FM Band 88 to 108 Mc
- Top Quality Components
- 8 Tubes (including Rectifier) Supplied
- Easily Assembled

Model T8CK FM Receptor Kit, less wire & Solder, Net Price.....$29.97



MEISSNER MODEL T4AK POWER AMPLIFIER KIT

- Flat Within 2 db from 45 to 20,000 Cycles
- Tubes: One 6SN7G9, Two 6L6G & One 5Y3GT
- 3 Volts RMS Input Required
- 20 Watts Output With 5% Harmonic Distortion
- All Parts Furnished Including Drilled-Punched Chassis

Model T4AK Power Amplifier Kit, less wire & solder, Net Price....$30.98

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BROADCAST BAND SUPERHET KIT

Easily constructed AC-DC Broadcast Superhet. 5 tubes including rectifier. Unusual performance and appearance. Ideal for class-room project, parts will withstand repeated rebuilding. Model T10-1191-A Superhet Kit with speaker & tubes, less wire & solder, Net $16.30

BC & SW BANDS SUPERHET KIT

50 to 1600 kc & 6 to 18 mc. Six tubes including rectifier. MEISSNER engineering assures ease of construction and top performance. 5" speaker for extended audio response. High stability. Has that "factory appearance." Model T10-1199, 2 Band Superhet Kit with speaker & tubes, less wire & solder, Net $21.75

MEISSNER MFG. DIVISION
Maguire Ind., Inc.
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WRITE TODAY FOR FREE MEISSNER RADIO KIT FOLDER

PERSONAL NEWS

(Continued from previous page)

♦ HOLLIS H. DAHLER, director of Vocational Education at Kansas City, Mo., will be a member of the staff of the industrial education department of Northwestern State College, Natchitoches, La., for the 1950 summer school session.

♦ KONRAD WACHSMANN, 48, architect and designer, has been named professor in charge of advanced building research and design at the Institute of Design of Illinois Institute of Technology, Chicago, Ill.

♦ WILLIAM A. CASLER, 32, has been named assistant director of research at Armour Research Foundation of Illinois Institute of Technology.

Casler's appointment adds a second assistant director of research to the Foundation staff. He will be in charge of stimulating new fields of research and assist in the administrative operation of the research division.

♦ HARRY E. MASTERS has been named educational director of the L. S. Starrett Co., of Athol, Mass.

♦ WILLIAM K. GAMBLE has been made assistant state supervisor of agricultural education of North Dakota.

♦ WILBUR T. LOCKE has been appointed assistant state supervisor of agricultural education of Massachusetts.

News Notes

♦ This new 10-page booklet on the use of electric welding on the farm, published by the Westinghouse Electric Corp., 306 — 4th Ave., Box 1017, Pittsburgh 30, Pa., contains much for the up-to-date farmer.

Briefly discussed in it are the advantages and importance of electric welding to the farmer in solving his machine repair, metal cutting, brazing, and soldering problems.

Numerous on-the-job photographs and diagrams will further interest the reader. The chart opposite page 6 will serve as a guide to the proper selection of electrodes and equipment to use for various welding, brazing, and metal cutting jobs.

For a copy of B-4157, write Westinghouse Electric Corp., Box 868, Pittsburgh 30, Pa.

♦ Three interstate apprenticeship conferences will be held in May and June:

1. The Southern States Apprenticeship Conference, to be held in Electricians Hall, Miami, Florida, May 3, 4, and 5.

2. Western States Apprenticeship Conference, to be held in the Seaside Hotel, Seaside, Ore., May 22, 23, 24, and 25.

3. Eastern States Apprenticeship Conference, to be held in the Poland Springs House, Poland Springs, Me., June 8, 9, and 10.

The objective of these conferences will be to review and promote apprenticeship activities in the metal, building, printing, service, and miscellaneous trades throughout the states represented. Attending the conferences will be representatives of employers and labor; vocational education; federal, state, and local governments, including the U. S. Labor Department's Bureau of Apprenticeship and state apprenticeship agencies; civic and other groups concerned with apprenticeship.

These interstate conferences have been initiated by the Bureau of Apprenticeship, Washington, D. C., and will be carried out in co-operation with the state apprenticeship agencies.

♦ The New York State School of Industrial and Labor Relations is assisting the leading university of the Philippines, Ateneo De Manila, in gathering anti-communist films, transcriptions, and

(Continued on next page)

NEWS NOTES

(Continued from previous page)

audio-visual aids. These materials are being gathered for use in an intensive five-day institute sponsored by the Philippine university for priests from all parts of the Philippines. Rev. James J. McGinley, S.J., director of the Department of Social Sciences, Ateneo De Manila, is supervising the Institute. Professor J. James Jehring of the New York State School of Industrial and Labor Relations at Cornell University, is assisting Rev. McGinley in the gathering of this material.

♦ Saul Herbert Sternberg, a 16-year-old aspiring physicist from Bronx, N. Y., won the $2,800 Westinghouse grand science scholarship as the nation's top teen-age scientist in the ninth annual Science Talent Search.

Second place in the nationwide contest, carrying with it a $2,000 Westinghouse science scholarship, went to 17-year-old Donald Bruce McCormick of Oak Ridge, Tenn.

♦ The Topeka Trade School Radio Mechanics class has been making an intensive study of television during the past eight months. The training in this class includes the construction of the various circuits used in the average television receiver. Related theoretical study has been obtained by using the General Electric lesson books on principles and practices in television. Supplemental material is furnished by the Philco Company and John F. Rider, Inc.

Considerable experimenting has been conducted by the class in elimination of interference; also the merits of various types of antennas and height above the ground. This led to the construction of a suitable antenna tower extending 60 ft. above the roof.

♦ The nature, construction, and use of the Geiger-Muller counter, detector of radioactive radiation, is presented on an elementary level in a new booklet just published by the National Bureau of Standards and now available from the U. S. Government Printing Office.

National Bureau of Standards Circular 490, *The Geiger-Muller Counter*, is available from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C., at 20 cents a copy.

♦ A course in audio visual methods will be offered again this summer by the New York State School of Industrial and Labor Relations at Cornell University. The course is a feature of the school's summer session which will begin July 3 and continue through August 12.

Enrollees in the course will learn to operate sound slide machines, motion picture projectors, wire recorders and transcription players, and how to make effective use of posters, models, and charts and graphs.

Information concerning the course may be obtained by writing to the New York State School of Industrial and Labor Relations, Cornell University, Ithaca, N. Y.

♦ *The Show Must Go On* is a new film of special interest to school administrators faced with the perplexing problem of selecting proper sound motion picture equipment for their schools.

The film, released by Bell & Howell Co., 7120 McCormick Road, Chicago, Ill., traces the history of motion picture projection from the days of the nickelodean up to the present time.

The film is in full color and may be seen by writing Bell & Howell Company.

♦ The National Safety Council, 20 North Wacker Drive, Chicago 6, Ill., offers a safety quiz on film.

The film is titled "What's Your Safety I.Q.?" and it shows common, unsafe, off-the-job actions and conditions that can cause accidents in the home, in traffic, and in recreation. As each set of hazards is shown workers are asked "What's wrong with this picture?" and are given from 12 to 15 seconds to spot safety errors. Then the narrator points out the hazards in each situation and tells what could be done to remove or avoid them, forestalling accidents before they occur.

"What's Your Safety I.Q.?" is available from the National Safety Council both as a 35mm. sound slidefilm and in a new, inexpensive type of 16mm. picture. Each has the same script and illustrations.

For further information, write to the National Safety Council.

♦ A new 15-room, one-story school-building annex to the Fairmont School at Bangor, Me., this winter has provided heating engineers with a made-to-order laboratory for the study of heating methods.

The annex is radiant heated throughout, including six classrooms. The new structure was added to a multi-story brick building which is steam heated.

The school is located in a "cold belt" section, which provides an excellent proving ground for side-by-side comparison of radiant and steam radiator heating in providing occupant comfort and operating costs.

The annex was designed to include hundreds of square feet of glass window area, intended to provide the best possible natural lighting. The generous use of glass also presented a heating problem which is normally difficult in these cold weather areas.

The designers, Eaton Tarbell and Associates, felt the radiant heating system has proved very satisfactory.

♦ Graduate assistantships in the College of Education, University of Illinois, Urbana, Ill., will be offered to superior graduate students in: agricultural education, child development, curriculum, educational psychology, guidance, home-economics education, industrial education, measurement and evaluation, school administration and supervision, social foundations of education, social psychology

(Continued on next page)

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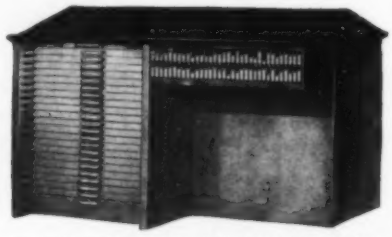

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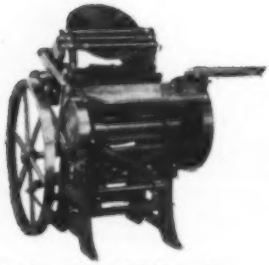

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NEWS NOTES

(Continued from previous page)

and its applications to education, special education of exceptional children, statistical and research methods, teaching at elementary or secondary level, teacher education and teacher personnel problems.

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Further information and application forms may be obtained from Professor F. H. Finch, 105 Gregory Hall, University of Illinois, Urbana, Ill.

Questions and Answers

TRAINING FILMS

1141. *Q.* I am seeking information on an index of training films. Can you suggest any companies who might be of help? — *H. W. B.*

A. Probably the following will assist you in locating what you want:

Educators Guide to Free Films, Educators Progress Service, Randolph, Wis.

1949–1950 Catalog of Educational Films of Merit, Bailey Films, Inc., 2044 North Berendo St., Hollywood 27, Calif.

The Jam Handy Organization, 2900 E. Grand Blvd., Detroit 11, Mich., also markets a large number of shop films of various kinds.

The Committee on Consumer Relations in Advertising, Inc., 420 Lexington Ave., New York 17, N. Y., offer the following two publications, each of which cost $1.50: *Business-Sponsored Educational Films*, and *Business-Sponsored Educational Materials*.

Castle Films, Div. of United World Films, Inc., 455 Park Ave., New York 22, N. Y.

Coronet Instructional Films, 919 N. Michigan Ave., Chicago 11, Ill.

Society for Visual Education, 1345 West Diversey Parkway, Chicago 14, Ill. — *J. J. M.*

New Publications

The Art of the Lapidary

By Francis J. Sperisen. Cloth, 382 pp., 6⅜ by 9½ in., illus., $6.50. The Bruce Publishing Co., 400 No. Broadway, Milwaukee 1, Wis.

This is a very complete book on the art of cutting, polishing, and fitting semiprecious and precious stones and gems.

The author explains the physical characteristics of gems and their classifications quite clearly. He also shows what tools and equipment are needed for sawing, grinding, and polishing cabochons and faceted stones, and gives well-illustrated, understandable directions on how to do all of these operations.

Drilling; engraving and carving; mosaic, inlay, and parquetry; and diamond polishing; are all clearly described.

The author has made much of the equipment which he uses in his work with stones and gems.

Industrial Arts Woodworking

By John L. Feirer. Cloth, 295 pp., 6⅜ by 9¼ in., illus., $2.60. Chas. A. Bennett Co., Inc., Publishers, Peoria, Ill.

A text that is well printed and illustrated. It helps the beginner get started right, shows him what tools to use and how to use them, and keep them in usable condition.

The making of joints also is explained, how to assemble the separate pieces that go to make up an article, how to prepare them for finishing, and finally how to apply the proper finish.

Games You Can Make and Play

By Paul V. Champion. Cloth, 128 pp., 6¼ by 9⅜ in., illus., $2.50. The Bruce Publishing Co., 400 N. Broadway, Milwaukee 1, Wis.

A fine collection of games which can be made of salvaged box lumber and with a few simple tools that are found in almost every home.

Twenty-eight game boards and tables are described. Detail drawings accompany every description, and in many cases, there is a half-tone illustration which further assists the one who wants to construct the articles described in this book.

Problems in Mechanical Drawing

By A. S. Levens and A. E. Edstrom. Paper cover, 56 pp., 8½ by 11 in., $1.48. McGraw-Hill Book Co. Inc., New York, N. Y.

This workbook is based on the text, *Mechanical Drawing*, by French and Svensen, and is designed for a beginning, first- and second-semester course.

The book contains exercise plates for lettering; ruling; measuring; geometrical figures; template layouts; and orthographic, isometric, and freehand drawing. Considerable emphasis is placed on the

(Continued on page 40A)

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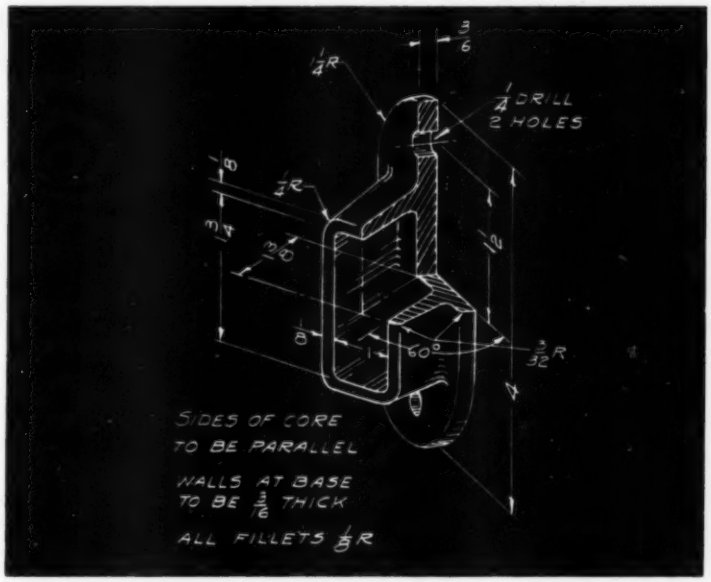

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19. WOODWORKING WORKBOOK *Nichols* $ .56
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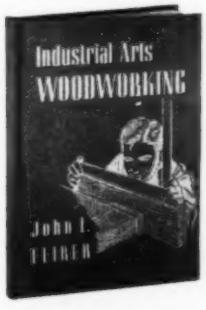
35. FUNDAMENTALS of SOFT SOLDERING *Yerkow* $2.25



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NEW PUBLICATIONS

(Continued from page 38A)

freehand drawing although drawing with instruments is, by no means, overlooked.

The Joy of Hand Weaving

By Osma Couch Gallinger. Cloth, 306 pp., 7¼ by 10¼ in., illus., $4.25. International Textbook Co., Scranton, Pa.

The author of this book is an enthusiastic and expert weaver herself. She has practiced and taught this art for years.

The book is written in a clear and entertaining manner and will, no doubt, have many friends.

The subject matter is presented in 37 instructional units.

Besides the history of weaving, the book contains the story of threads made of different kinds of material. It also describes how to get the loom ready for weaving, choosing colors, preparing the warp and setting up the loom, using and designing drafts in weaving, and weaving on two-harness and four-harness looms.

Radio Operator's License Q & A Manual

By Milton Kaufman. Cloth, 608 pp., 5⅝ by 8½ in., illus., $6. John F. Rider Publisher, Inc., New York 13, N. Y.

This is quite a complete collection of the questions used by the Federal Communications Commission in its past exams for commercial licenses for operators of radiotelephones, radiotelegraphs, amateur radio operators in classes A, B, and C.

Each question is answered and there also is a follow-through discussion so that the reader can get a thorough understanding of the technical answer given.

The questions and answers cover basic radio laws, rules, and regulations; basic theory and practice; the radiotelephone, advanced radiotelephone and telegraph; advanced radiotelegraphy; and rules governing amateur radio questions and answers.

The appendix covers the rules which govern commercial radio operators, extracts from the radio laws, abbreviations used in this field, the international Morse code, small vessel direction finders, and automatic alarms.

Crafts for Everyone

By Louis V. Newkirk and LaVada Zutter. Cloth, 210 pp., 8 by 10¾ in., illus., $3.50. International Textbook Co., Scranton 9, Pa.

An interesting and helpful book for those who are interested in doing craftwork themselves or in teaching it to others.

The craft media covered are wood, metal, leather, plastics, textiles, and paper.

The objects described can be made with hand tools. The explanations throughout the book are clear and understandable, and the illustrations are excellent.

Automobile Body Rebuilding and Refinishing

By William K. Toboldt. Cloth, 464 pp., 5⅝ by 8¼ in., illus., $4. International Textbook Co., Scranton, Pa.

A book which discusses the entire question of auto body rebuilding and refinishing thoroughly.

It starts with an explanation of the kind of shop that is required for this type of work, and how it is to be laid out.

Then it discusses the types of repairs that are undertaken and the basic operations of the work.

Next, the rebuilding methods, and the repairing of individual parts are taken up, after which the paint shop, its management, tools and equipment, cleaning and paint removal, masking and spray painting are discussed and clearly explained.

The book is well illustrated throughout.

General Electricity

By E. W. Jones. Paper cover, 90 pp., 7¾ by 10¼ in., illus., $1. McKnight & McKnight Publishing Co., Bloomington, Ill.

This is a new edition of this text on elementary electricity. The book is arranged so that its application to any particular class can be made very readily. It contains 23 teaching units.

To show how flexible it is, one needs but to see the author's suggestions on the table of content's page, where he advises what parts of the text to include for a 6 to 9 week's course, for one of 12 week's duration, and for a semester's course.

Welding Handbook

Prepared under the direction of the Welding Handbook Committee. Cloth, 1650 pp., 6¼ by 9⅛ in., illus., $12 per copy in the United States and Canada; $13 elsewhere. Published by American Welding Society, 33 West 39th St., New York 18, N. Y.

This is the third edition of this valuable handbook. It is a very complete source of information on welding and contains up-to-date information in readable form. The handbook is intended to be useful, both as a text on welding and as a reference book.

Twenty-seven chapters are devoted to the more than 30 welding and cutting processes used in industry today. Information on each process covers the equipment used, the basic principles of operation, and the application of the process for different metals and different industrial applications.

Thirteen chapters contain information on the ferrous and nonferrous metals commonly welded.

A group of 11 chapters contains information on design, material, workmanship, and inspection requirements for industrial applications such as aircraft, bridges, buildings, railroads, storage tanks, pressure vessels and boilers, ships, automotive products, pipe lines, industrial piping and machinery.

Additional individual chapters are devoted to data for estimating costs, physics of welding, welding metallurgy, a dictionary of welding terms and definitions, general engineering tables for shop and office use, and welding standards, including welding symbols, filler metal specifications, and standard tests for welds.

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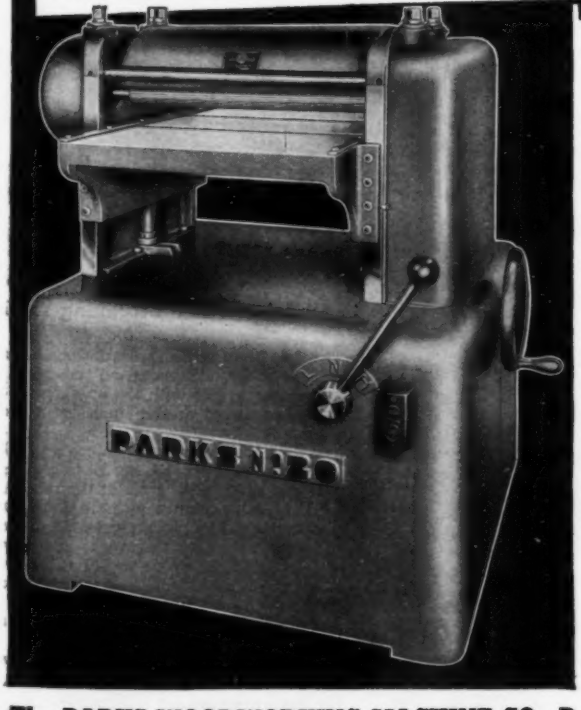

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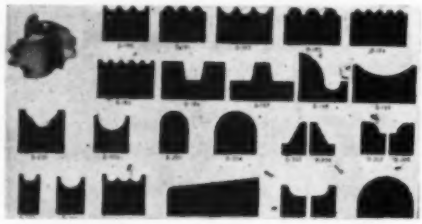
Shop Equipment News

NEW PRODUCTS — PUBLICATIONS

DELTA-MILWAUKEE 3-LIP SHAPER CUTTERS

The Power Tool Division, Rockwell Mfg. Co., Milwaukee 1, Wis., announces a new series of Delta-Milwaukee 3-lip shaper cutters for use on any shaper that has a ½-in. spindle. Numerous different shapes and moldings can be made with these new 3-lip cutter knives.

These Delta-Milwaukee cutters are made of special alloy steel and hardened in oil. They can be resharpened merely by grinding across the face of the cutting lip. This grinding will not distort the true shape of the knife.



Delta-Milwaukee 3-tip cutters

These Delta-Milwaukee cutters have an involute relieved cutting edge, which provides a large rake angle that permits the cutter to make a shearing cut, instead of a scraping cut.

Bulletin AD-528, entitled "Moldings by the Thousands," available on request, gives details on these new Delta-Milwaukee 3-lip cutters and also describes small-radius 3-lip cutters for shapers or drill presses with a 5/16-in. spindle. Diagrams show how Delta-Milwaukee cutters can be combined for various cuts.

For brief reference use IAVE—0501.

NO. 3MI MILLING MACHINE

The Cincinnati Milling Machine Co., Cincinnati 9, Ohio, has just placed its No. 3MI milling machine on the market. This miller is equipped with hand and power rear controls and is powered with a 7½-h.p. motor.

No. 3MI milling machine

It may be ordered either plain or universal. Both types have 62½ by 14-in. working surfaces. The longitudinal range is 34 in., and the cross feed is 12 in.

There are 16 longitudinal and cross feeds, ¼ in. to 30 in. per min., and the longitudinal and cross power rapid traverse rate is 150 in. per min., while the vertical rate is 75 in. per min.

For brief reference use IAVE—0502.

NEW STANLEY PULL-PUSH RULE

Stanley Tools, New Britain, Conn., announces the new Defiance No. 1262 "Pull-Push" Rule.

Stanley Pull-Push rule

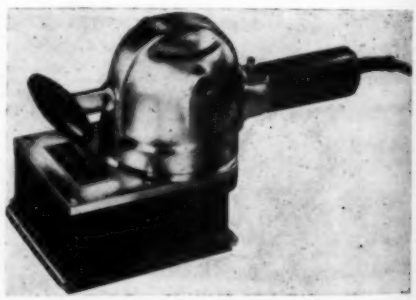
This rule has a D-shaped case making it particularly handy for inside measurements. It has a ½-in. blade, 6 ft. long, graduated in 16ths for its entire length and in 32nds on upper edge for the first 12 in. The blade is nickel plated with numbers and graduations printed in black for easy reading. The blade can be removed from the case for end-to-end measurements.

For brief reference use IAVE—0503.

THE REDESIGNED 438 SKIL OSCILLATING SANDER

An easy-to-use metal clamp for rapid paper attachment heads the list of improvements on the new, redesigned Model 438 Skil Oscillating Sander.

This simple clamp fits into grooves at both ends of the sanding head, securely holding the paper over the vibrating head. Older models may be easily and inexpensively adapted to use this new clamp. Sandpaper may also be applied with cement.



Model 438 skill oscillating sander

The new improvements also include a dampener that practically eliminates all vibration, a redesigned rear handle with thumb operated switch, and an improved motor housing for efficient cooling.

The Skil Oscillating Sander's compound motion cuts against the grain at the leading edge of the sander and sands with grain at the rear.

Gearless drive assures near-silent and trouble-free operation. The model synthetic rubber head won't mar or gouge the work, and allows the user to work right up to moldings, recesses, and corners. It is ideal for furniture, cabinet, and other types of wood finishing.

Net weight of sander is 7½ lb. Abrading surface, 4½ by 5½ in.

For further information address Skilsaw, Inc., 5033 Elston Ave., Chicago 30, Ill.

For brief reference use IAVE—0504.

(Continued on page 44A)

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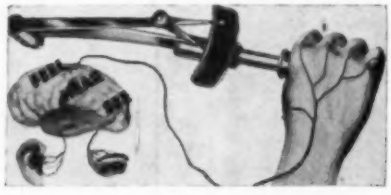
SHOP EQUIPMENT NEWS

(Continued from page 42A)

NEW PROTO TORQUE WRENCHES

Twelve high-speed Proto torque wrenches that are controlled by feeling, sound, and sight, have been annuonced by the Plomb Tool Co., Los Angeles, Calif.

A trip lever is set at the desired torque reading, and when the wrench is pulled to this exact reading the lever trips a signal trigger. At the same instant a click is heard and a definite impulse is given to the operator's hand. The operator may also watch a pointer advance along an easy-to-read dial and see when the proper torque is reached.



Proto torque wrenches are controlled by feeling, sound, and sight

This type of torque wrench eliminates dangerous strains, breakage, binding, loosening, chatter, leakage, squeaks, and stripped threads of nuts, bolts, and other threaded parts.

The new Proto torque wrenches have a sturdy, one-piece, flat beam measuring element, which is said to be permanently accurate and indestructible with ordinary use.

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For brief reference use IAVE—0505.

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The Quick-Kraft Shaper Set consists of 5 cutter blades, a plastic shaper guard, and a ½-in. shaft which fits the chuck on a standard drill press,

Quick-Kraft shaper set

the whole to act as a low cost shaper. Speed of cutter should be from 4500 to 10,000 r.p.m. for good shaping.

For further information write to *L. F. Walner, V-3, 921 E. Cedar Ave., Burbank, Calif.*

For brief reference use IAVE—0506.

(Continued on page 46A)

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Chicago, Illinois

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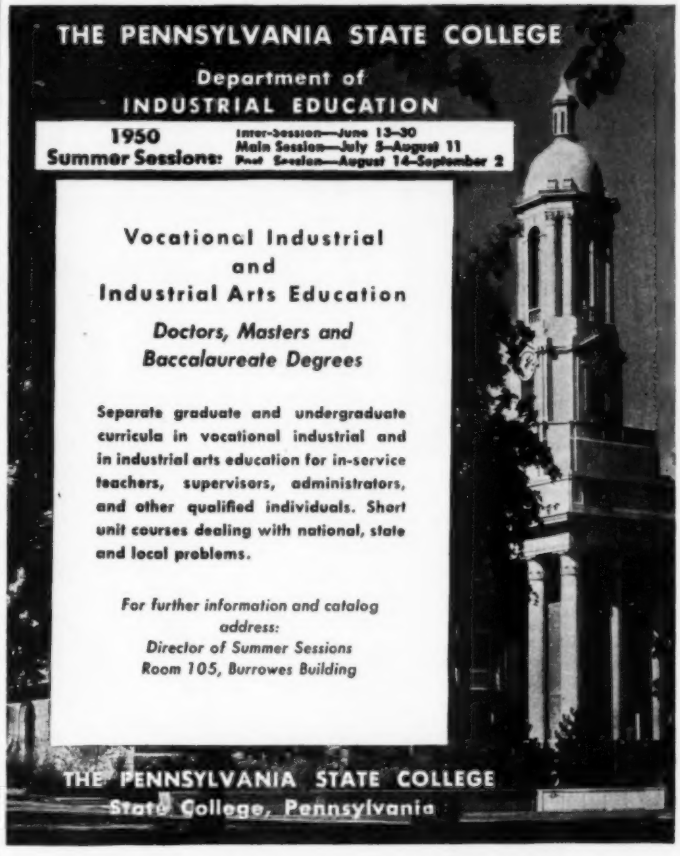
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Write for new Catalog No. 60, describing the complete line of Sterling Foundry Equipment.

Sterling FOUNDRY FLASKS
STERLING WHEELBARROW COMPANY - MILWAUKEE 14, WIS., U.S.A.

SHOP EQUIPMENT NEWS

(Continued from page 44A)

NEW WOOD-BORING BITS FOR ELECTRIC DRILLS

A new line of wood-boring bits for use in ¼-in. portable electric drills is now being offered by Greenlee Tool Co., 2136 — 12th St., Rockford, Ill. These bits have been developed to meet the need of carpenters and other woodworkers using electric drills for boring ½-in. or smaller holes in soft- or hardwood.

Greenlee wood-boring bits

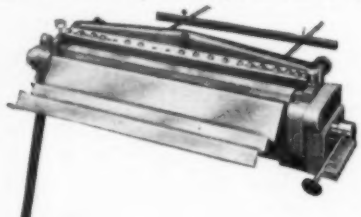
They are of solid-center design and have the single-cutter, extension-lip type head with outlining spur. No pressure is required and holes are bored quickly and smoothly.

The new Greenlee Electric Drill Bits come packaged as a set comprising five bits of 5/16, 7/16, 9/16, 7/16, and 5/16 diameters. The bits may be purchased as a set or individually.

For brief reference use IAVE—0507.

CORRECTION

In the main illustration of the Berkroy Shop-On-A-Bench advertisement on page 44A of our March issue, the inset photo erroneously shows the Berkroy 12-in. folder brake. It was Berkroy's intention to illustrate the larger and more versatile 24-in. box and pan brake in the inset photo. The above illustration shows the Berkroy 24-in. box and pan brake in action, handling a series of reverse bends in 16-gauge stainless steel. The 24-in. brake forms boxes from ½ to 24 in. and handles many types of intricate folds and radius bends. A positive angle stop provides infinite adjustment to any desired angle between 0 to 135 deg. *Finger-Tip* thickness adjustment knobs and Torrington needle bearings for smoothness and accuracy are additional features.



Berkroy 24-in. box and pan brake

For further details, write *Berkroy Products, Inc., 2512 N. Ontario St., Burbank, Calif.*

For brief reference use IAVE—0508.

(Continued on page 48A)

***New* 12 INCH NORTHFIELD PRODUCTION JOINTER**

Northfield Production Jointers, heavy duty, ball bearing, motor driven, with extra long tables 74" overall mounted on long incline ways. Round three knife safety heads iron adjustable fence 45" x 5", direct motor drive, 3 H.P. 220/440 Volt, 60 Cycle, 3 Phase, 3600 R.P.M. magnetic starter, with overload and undervoltage protection, with safety guard.

8" machine weighs 1000 lbs.
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12" machine weighs 1050 lbs.
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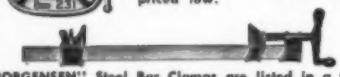

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200 V LAFAYETTE ST. • N.Y. 12, N.Y.

SHOP EQUIPMENT NEWS

(Continued from page 46A)

NO. 2 AMACO POTTER'S WHEEL

This newly designed wheel is a compact table-model unit, incorporating mechanical improvements which are intended to give greater ease and comfort to the pottery worker.

No. 2 Amaco potter's wheel

The mechanism is enclosed in a heavy aluminum casting. The over-all size is 30 by 19 by 14 in. The inside forms a natural drain to a removable water reservoir.

The wheel is powered by a ¼-h.p. motor. It revolves at 30 to 160 r.p.m. It is equipped with a built-in wedging wire and an adjustable tool or arm rest.

It weighs only 110 lbs., and can be plugged into any single phase 110-115 volt a.c. electric circuit.

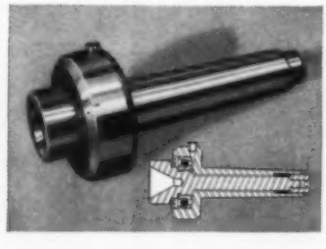
The motor also can be converted to single phase 220-230 volt a.c. electricity.

For further information address American Art Clay Co., 4717 West 16th St. Indianapolis 24, Ind.

For brief reference use IAVE—0509.

LIVE CENTER FOR CENTERLESS SHAFTS

A new live center designed especially for supporting centerless shafts is now being manufactured by the South Bend Lathe Works, South Bend 22, Ind. The 60-deg. cup receives the shaft end, as shown in the cross section shown in the cut. Two sizes are available, one with No. 3 Morse taper shank and maximum work capacity of 1 in., and the other with a No. 2 Morse taper shank and ¾-in. work capacity. Both sizes will take work diameters down to 5/16 in.



Live center for centerless shafts

The revolving center is made of electric furnace steel, heat-treated to a hardness of 61 to 65 Rockwell C. The center shaft extends through the taper shank and is rigidly supported at both ends. A specially designed precision ball bearing carries both the radial and thrust loads of the work, and a plain pilot bearing eliminates center shaft whip. All parts may be easily replaced in event of damage.

For brief reference use IAVE—0510.

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(Continued on page 59A)

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22 pounds
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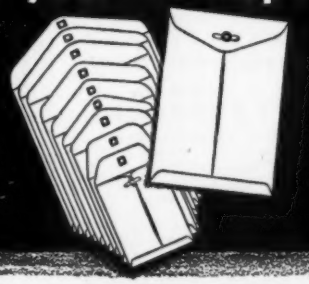

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WESTERN STATES *Envelope Company*
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INSTRUCTION BOOKS
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SHOP EQUIPMENT NEWS

(Continued from page 48A)

based on some of the texts published by them.

Those available now are for the following tests: *Furniture Joinery, Safety Know-How in the Woodshop, Making a Project with Handtools,* and *Woodworking Machines.*

These film strips can be used in any standard film strip projector as well as in the S.V.E. Tri-Purpose and Picturol projectors.

For further information address the firm mentioned in the foregoing.

For brief reference use IAVE—0511.

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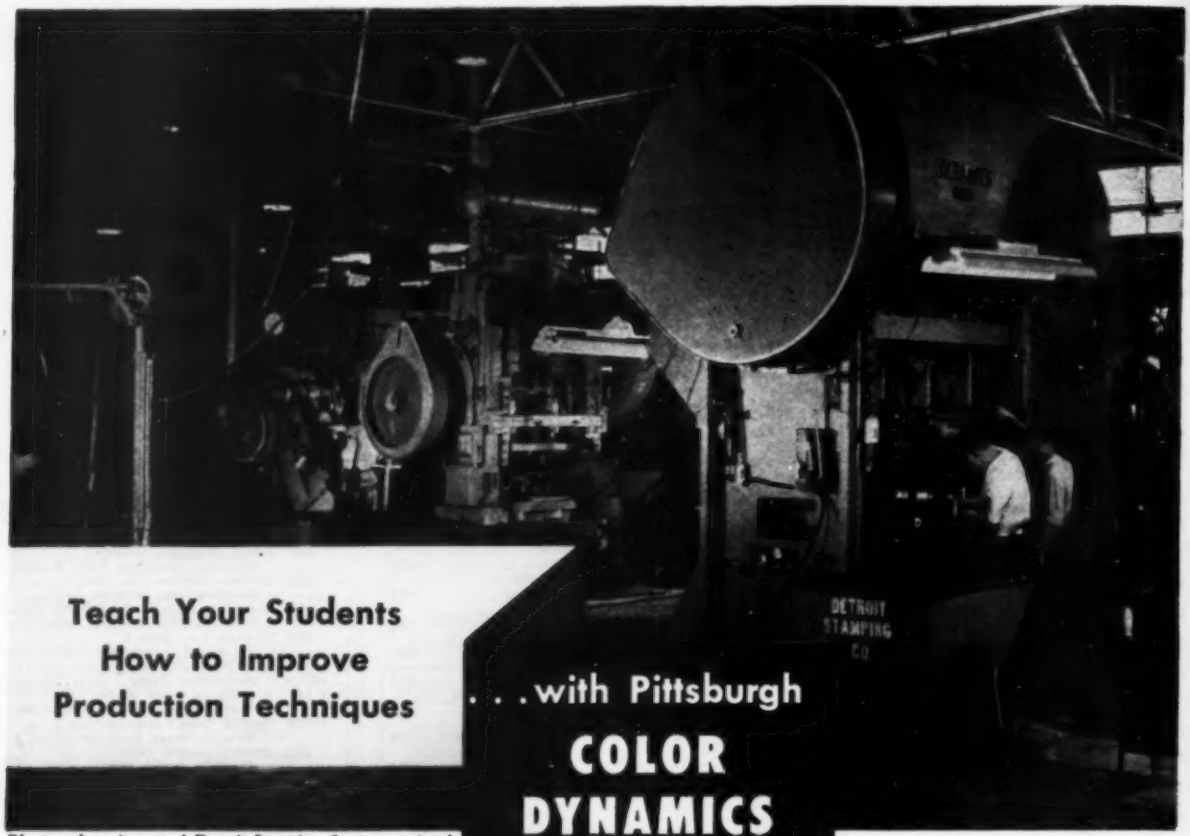

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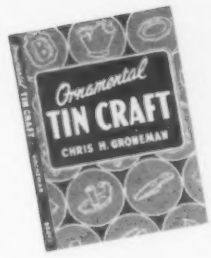

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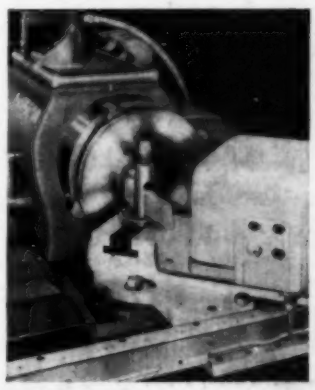
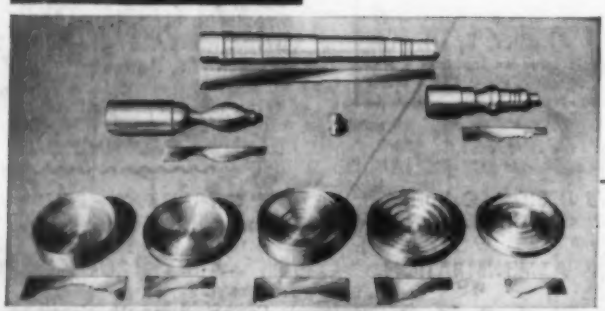
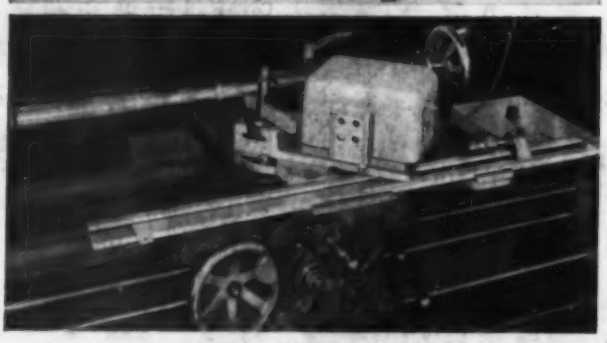
"THE DUPLICATOR operates on the template-tracer principle—the stylus pointer traces the contour of the template and reproduces the design in metal. Operation is easy: just set up the rough stock, push the 'in' button to run the tool to the starting position, then push the 'automatic' button.

"FOR SHAFT JOBS (at left), the template holder is set parallel to the bed and the bracket is bolted to the tailstock end of the bed. For profile facing (right) swing the holder around perpendicular to the bed. Both adjustments require only a few minutes . . . Note controls always remain in the same handy position.





"AN IDEA OF THE VARIETY of production contouring that can be performed with the duplicator may be obtained from the photo at left. This new attachment uses a flat template which can be made in any shop. The same template can be used for both rough and finish turning."



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